The
DENTAL JOURNAL
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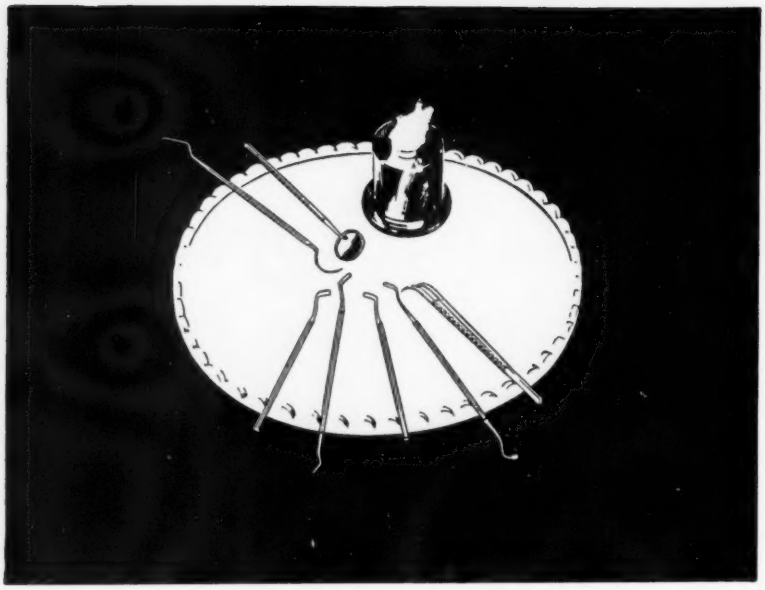

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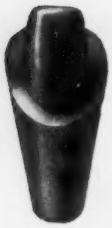

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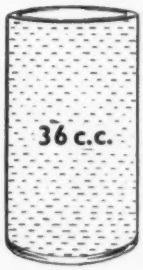

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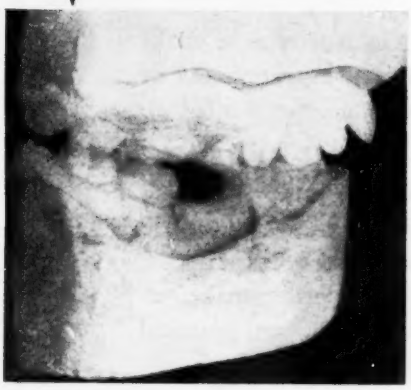

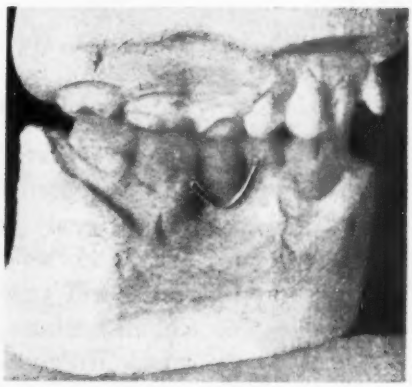

Fig. I. FEMALE: Aged 32. Marked over-closure of the bite with lower incisors biting heavily on to the palatal mucous membrane, resulting in the 21/12 being displaced labially. Fig. II. A VIRILIUM skeleton raised-bite plate was fitted. For aesthetic reasons (the patient had a very wide smile) the occlusal and buccal surfaces were covered with hard acrylic. Lengthening the vertical dimension vastly improved the patient's appearance, and freeing the bite from the palatal mucous membrane allowed the normal labial pressure partially to correct the displacement of the upper incisors.

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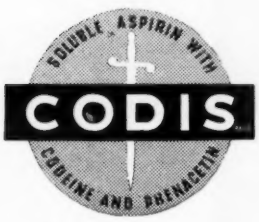

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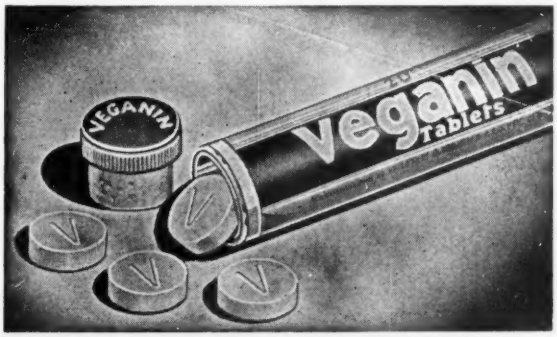

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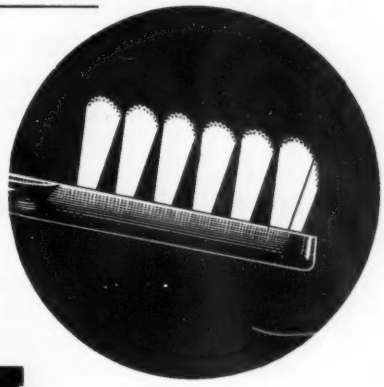

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Passive Changes In The Enamel Surface And Dental Caries*

Basil G. Bibby, Ph.D., D.M.D.†

My studies of dental caries are based upon Dr. Pickerill's statement that "if dental decay is to be prevented, it must be prevented at the enamel surface." Thus, believing that a study of the enamel surface was an all important aspect of any attempt to control the activity of dental decay, I have focused my attention on it, but during my research activities have, from time to time, made several wide detours from this central path. In our early investigations we did what most people, who are somewhat innocent in the field of research, would do — we organised a good "paper" research project on the enamel surface. We divided it into four parts: someone was to work on the inorganic structure of the enamel surface, someone on the organic structure, someone on the saliva and someone on the bacteria. The result was my first detour of five or six years during which I tried to find out something about bacteria which colonize on the enamel surface. In the meantime I maintained an interest in various other aspects of the surface problem and initiated, or perhaps I should say, promoted small investigations in them.

At this time I do not intend to discuss the bacteria of the tooth surface, but rather to consider what changes should be brought about on the enamel surface if it is to be made more resistant and thus contribute to the control of dental decay. As a start, we should examine the changes which do occur on the enamel surface in the hope that they may have some significance in the hunt for methods of controlling caries.

We will assume for the present that the principal destructive mechanism of decay is the solution of the inorganic portion of the enamel in acids elaborated by bacteria. If this is so, there are two possibilities of increasing the resistance of the enamel surface: one would be to change the nature of the inorganic component so that it would be more resistant to acid and the other would be in some way to bring about modifications of the organic material in the enamel surface so that it would slow down the acid attack or actually protect the associated inorganic structure.

First of all, what do we know about the solubility of the enamel surface? As you can well understand, it is a very complex problem. It is not difficult to show that acid will dissolve the enamel surface, to determine the solubility of powdered enamel or to measure the solution of a flat, ground enamel surface, but to measure, on an accurate and comparative basis, the solubilities of natural enamel surfaces presents some very special problems. Enamel surfaces are invariably very irregular and, even if there were no surface irregularities, a standard area cannot be isolated because the curvature of teeth varies. Teeth cannot be pooled for study because it is quite likely that the solubility of different teeth will vary widely. The only way that we have been able to make a quantitative comparison of tooth solubilities has been to use pieces of material, such as foil, with a standard sized hole in it. If this material is sealed over the tooth surface, a window of standard size is obtained and the problem of different surface curvatures can be overcome. The amount of material which will dissolve from a surface area of a millimetre in diameter exposed in the test windows is very small, therefore, microchemical techniques must be used to measure the minerals going into solution in acid. Dr. Brudevold has worked out accurate methods for making calcium and phosphorus determinations from the small amount of substance dissolved from one of these standard windows. His results are somewhat discouraging, because he has found that no two tooth surfaces are equally soluble and that even different areas of the same tooth can vary in solubility by as much as 10 to 1. However, in spite of these difficulties, he has established one or two interesting facts. Firstly, the external portion of the enamel has a greatly reduced solubility as compared with successively deeper layers. This resistant layer at the surface of the enamel is about one micron thick. Secondly, slightly reduced solubilities were found in the enamel surface of old teeth as compared with young teeth.

This method was also used to try to determine the effects of various agents such as compounds of lead, indium, fluorine and so forth, on enamel surface solubility, but it was only possible to produce statistically significant differences in enamel surfaces which had been etched or abraded. This supports the

*A discussion delivered at the United Dental Hospital on November 17, 1953, under the aegis of the Faculty of Dentistry, University of Sydney and the Institute of Dental Research. Chairman: Professor A. J. Arnott.

†Director, Eastman Dental Dispensary, Rochester, New York, U.S.A.

finding that there is some difference in solubility between the outer and the deeper enamel and indicates that the natural surface is not as susceptible to changes in solubility by extraneous treatment as are the deeper layers. The nature of this outer surface will be considered in the second part of this discussion.

Another method of measuring the solubility of enamel is to break it into a powder of a standard particle size. By this method it has been shown that a variety of agents will reduce enamel solubility. Twenty-five per cent. of powdered enamel treated for twenty minutes in a standard buffer, such as acetic acid, at pH 4.0 may go into solution. If the enamel is treated previously with sodium fluoride for a minute or so, the solubility is reduced to about 16 per cent., although these figures vary quite widely from one batch of enamel to another. Thus in powdered enamel we can establish the effect of fluorine in reducing solubility. It is interesting to note that the most effective agent we have found for reducing enamel solubility in vitro is not fluorine: lead is more effective. Actually, we have found thirteen different ions, including lead, gallium, indium and arsenic, which have a greater effect in reducing the solubility of powdered enamel than has fluorine. Indium and lead perborates gave reductions of as much as 95 per cent. We found another interesting fact, namely, that if we acidulated the sodium fluoride, we obtained a greater reduction in enamel solubility than with neutral fluoride solutions. It was evident then that, if the findings of our laboratory investigation on powdered enamel could be applied directly in clinical techniques then agents, such as lead or indium borate or acidulated fluorides, might produce a greater reduction of dental decay than did treatments with sodium fluoride.

On the basis of these findings we set up a number of clinical tests. Now, if we were to get too enthusiastic about laboratory findings, we might assume that when we use lead fluoride we should produce about 90 per cent. reduction of dental decay; if we use indium fluoborate (which produced a 95 per cent. reduction in enamel solubility in vitro), we should get a 95 per cent. reduction; or, if we use acid sodium fluoride (which produced about a 60 per cent. reduction in a test tube), we should get a 60 per cent. reduction. However, clinical tests showed that indium nitrate gave no reduction of dental decay; lead fluoride, a 4-20 per cent. reduction; acid sodium fluoride, a 20 per cent. increase and some of the fluoborates a 300 per cent. increase in dental decay. The results show that the factors modifying solubility in vitro are not the same as those acting in clinical caries. This suggests to me that we should learn more about how fluorine acts on the enamel surface or on calcium phosphate.

Why a difference should exist between the efficacy of acid sodium fluoride and neutral sodium fluoride is not understood. It is probably due to the fact that, when neutral sodium fluoride is used, some of the hydroxyapatite, which makes up the inorganic portion of the enamel, is changed to fluorapatite, but when an acid sodium fluoride is used, calcium fluoride is formed. This calcium fluoride apparently is not bound into the enamel as part of its crystal structure, but in in vitro experiments when the enamel is not subjected to the physical and chemical hazards of the mouth, it persists as a layer on the outside which protects the inner part of the particles from the action of acid. Clinically, however, the calcium fluoride is not retained on the tooth surface so that the effect of acid sodium fluoride has merely been to replace the hydroxyl and perhaps phosphate ions of the enamel surface by a loosely adsorbed layer of calcium fluoride which is quickly lost in the salivary environment. The net result is that the natural surface of the tooth has been removed and temporarily replaced by calcium fluoride which is quickly lost exposing the underlying enamel which, as has been indicated above, is more easily destroyed than the original enamel surface.

The possibility of the formation of fluorapatite on the enamel surface has been the subject of considerable investigation. Quite a lot of work has been done in Indiana in this connection because of its possible significance in explaining the relative efficacy of treatments with stannous fluoride and sodium fluoride, in the inhibition of caries. In the surface changes brought about by different concentrations of various fluorides, both acidulated and nonacidulated were studied by means of electron and X-ray diffraction. Low concentrations of fluoride produced some fluorapatite in the surface enamel, but calcium fluoride could not be shown. When high concentrations of sodium fluoride, other fluoride salts or acidulated fluoride were used, calcium fluoride was formed on the surface of and within the particles of enamel according to the methods used. Thus, it seems that whether calcium fluoride is formed or not is determined by the concentration of fluoride used and its acidity. The permanence of these calcium fluoride enamel combinations has not been established, and there is reason to believe that the fluoride is only loosely combined.

Quite a number of studies have been carried out to try to determine whether there is an increase of fluorine in the enamel surface

after treatment of the tooth surface with fluorides. In general, they seem to show that there is such an increase. It has been indicated that there is greater uptake of fluoride if the tooth is cleaned or abraded, which is in keeping with Dr. Brudevold's solubility findings. The degree of uptake varies to some extent with the length of application of 2 per cent. sodium fluoride, but a lot of the fluorine is lost during washing. It appears that to bring about the most desirable type of change in the enamel surface, it is preferable to use a low concentration of sodium fluoride. This is supported by the recent evidence of Rathje and by Bonner and others at the University of Rochester which indicates that, as long as the concentration of fluoride in solution is less than that given by a saturated solution of calcium fluoride (about 20 ppm.), calcium fluoride will not precipitate on the enamel surface, and a fluorapatite may be formed which will integrate into the tooth structure.

Rathje has carried out studies on the precipitation of phosphates in the presence of small amounts of fluoride and he has come to the conclusion that fluoride combines with the phosphate to form a hydroxyfluorapatite. A fluorapatite is not formed but instead a partial replacement of the hydroxyl ions by fluoride ions takes place in the apatite structure. If there is no fluoride present in the precipitated calcium phosphate, 3 milligrams of calcium will go into solution when treated with acid. But, if 2 ppm. fluoride are present, only 1 milligram of calcium goes into solution. If the fluoride is increased to 10 ppm. 0.5 milligram of calcium will still go into solution. In other words, the greatest reduction in solubility of calcium phosphate is produced with concentrations of fluoride of only 2 ppm. and increasing the concentration five-fold only halves the effect. From these results, Rathje deduces that fluoride at concentrations of 1 or 2 ppm. in the drinking water may have its effect by changing the hydroxyapatite of the enamel surface to a hydroxyfluorapatite. He therefore suggests that the principal action of fluoride in drinking water does not occur during the formation of the tooth but is the result of its effect on the external portion of the enamel after eruption. From time to time we have suggested that this may be the mechanism involved, and it is interesting to note that this view is no longer regarded as a peculiar conviction of an unorthodox minority. The reasons for giving more credence to the idea that fluoride in the drinking water acts on the outside of the tooth rather than having its effect only during enamel formation are to be found in the results of investigators working in areas where artificial fluoridation of water supplies has been adopted. Reductions in dental decay of up to 60 per cent. have been found in children whose teeth were already erupted at the time fluoride was added. The same thing has been noted when children moved into the areas with fluorine waters. That a continuous renewal of the fluoride in the tooth surface is needed in order to maintain the maximum resistance to dental decay is indicated by Russell's findings that, when children move out of areas where fluoride is added to the drinking water, their susceptibility to dental decay increases.

The radioactive isotope of fluoride has been used in the University of Rochester laboratories to study the uptake of fluoride on the enamel surface. By using a hard wax cradle, it is possible to set a tooth on a standard window in a lead plate so that it later can be easily replaced in the same position. The tooth can then be removed and placed in a solution of radioactive fluoride or treated in other ways and returned to the cradle position so that the radiation can be detected by a counter placed opposite the window. The actual quantity of fluoride combining with the enamel surface can then be calculated. It is found that when the surface of the tooth is ground the uptake of fluoride is greatly increased. If the tooth is immersed in acid and slightly etched, there is about a ten-fold increase. These results fit in with the findings of Meyers and Becks in California who, using a different procedure of exposing a tooth with early caries to a solution of radioactive sodium fluoride and then taking a radioautograph of it, showed there was a greater fluoride uptake in the decalcified areas. This higher uptake of fluorine in freshly exposed or slightly etched enamel surfaces or in areas of early caries suggests that the effect of fluoride in reducing dental decay is not so much that it combines all over the tooth surface but that it is particularly active in areas where decalcification may be taking place. This theory fits in quite well with some of the clinical evidence on the distribution of caries in the mouths of children whose teeth have been treated with fluoride.

The idea I wish to stress more than any other is that there is evidence that replacement can occur, under both natural conditions and artificial conditions, of some of the ions in the inorganic phase of the tooth, thus reducing its solubility. There is good evidence that the fluoride ions will do this but, as I indicated earlier, we must not assume that fluoride is the only agent that will do it. For instance, there are findings on the distribution of lead in the tooth which suggest that it reacts in the same way as fluorine. Theoretically, we can reason that lead or any ion

which will form insoluble complexes with tooth substance might well influence the tooth solubility. On the other hand, we have to bear in mind that other combinations of ions with the inorganic compounds of the enamel may increase solubility. We need to know more about the reactions which may occur with the inorganic structures of the teeth.

Let us now discuss possible changes in the organic components of the enamel surface. In many teeth, there is no sharp line of demarcation between outside of the enamel and its inorganic structure. Instead, there is a transition from an obvious layer of bacteria through changed acid resistant "organic" structures to calcified enamel. Often one finds an area of pigmentation along the surface. In our opinion this is not an artifact, the result of poor sectioning or bad microscopy but represents some kind of change in the organic content of the enamel surface which is the result of the environment to which the tooth has been subjected.

Microscopically, such a surface exhibits a layering of pigmented material lying over normal or almost normal enamel structures. We theorized that this pigmented material was not something which was formed in the tooth at the time of formation but rather that it was the result of a slight enamel surface decalcification into which certain extraneous organic material (probably of salivary origin) had been deposited and which thereafter had undergone a change resulting in its being fixed in the enamel. Such an increase in the amount of organic material in the surface of the enamel could serve as an added defence against dental decay, because it could be expected to be more resistant to the action of acid than would the unpigmented surface. We have recently found evidence to support this hypothesis.

To find out whether there was in fact an increase in the depth of the pigmented surface layer during the life of the teeth, we took groups of teeth which were unerupted or which had been in the mouth for various periods of time and made ground sections to determine the depth of that pigmented surface layer. In the impacted teeth, no pigmented layer was found; in teeth up to ten years of age, there was no such layer; but in teeth ten to twenty years old the pigmented layer had an average thickness of 1/700 mm. with a density of pigmentation, which we empirically rated as from 0 to 1. Older teeth were pigmented to a somewhat greater depth and the intensity of pigmentation increased. Without going into more details, it can be stated that there is good evidence that there is in fact more of this pigmented material in the enamel surfaces of old people than in those of the young.

The increased pigmentation which has been observed by other workers and in older teeth may be related to this type of change in the enamel. This changed surface is quite resistant to decalcification and may be regarded as being organic in nature. This apparent increase in the layer of organic material probably accounts for Chase's finding that when he decalcified teeth in acid and removed the cuticle, membranes removed from old teeth were thicker than those from young teeth. At higher magnifications these surface membranes show bacteria on the outer surface and an amorphous layer of pigment on the inner side. In short, we believe that there is a thicker organic layer on the surface of old teeth than there is on the surface of young teeth. Chemical analyses have supported this by showing that the enamel of old (pyorrhetic) teeth contained more nitrogen than the enamel of young teeth. It seems that the common idea that there is a progressive calcification of teeth with age does not hold and should be replaced by a concept of a progressive decalcification with age and a replacement of the inorganic by organic material. This replacement of inorganic material by organic substances, which have a greater resistance to the action of acid than the rest of the enamel, explains two clinical observations. If we have a more resistant surface in old teeth due to an increase of organic material, we have an explanation for (1) the apparent greater resistance of older teeth to dental decay and (2) the clinically observed increase in pigmentation of teeth with age.

What is the nature of the organic material which is deposited and where does it come from? We can make several guesses. Perhaps, when the enamel surface becomes decalcified, bacteria, etc., will adhere to it and, if they are not disturbed by friction or motion of some sort, they will undergo a process of organic consolidation. One might be even more specific and assume, as Manley and his group have done, that there is a salivary impregnation of these areas. In some of the studies of the nature of the surface change there is evidence that there is a high content of nitrogen in the material which is deposited, and other properties of this material indicate that it is perhaps not typical protein but may have some mucopolysaccharide components. This suggests the possibility that the material deposited from the saliva may resemble chitin in some of its properties and perhaps its mode of formation. Regardless of the nature of the extraneous material which finds its way into the enamel, the existence of such a change in-

dicates a mechanism by which the saliva may be furnishing continuous protection to the enamel surface.

There is indeed recent evidence which demonstrates that the saliva does have such a protective role. It has long been known that if the salivary glands are removed dental decay is just about doubled in experimental animals, but to this has recently been added the finding that the increment of dental decay is increased proportionally the longer the pre-experimental absence of saliva. This suggests that where the glands have been absent for a long time, the teeth have been deprived of some protective agent from the saliva. Apparently, the saliva works continuously to reinforce the surface of the enamel against destruction.

If a conclusion, or shall we say a moral, needs to be drawn from this talk, it is that in considering dental caries we should bear in mind that there is more than one way in which the resistance of the tooth may be changed besides any of those which may depend upon the pre-eruptive or later metabolic influences on the teeth. These can be regarded as mechanisms of passive resistance which, by changing either the inorganic or organic structures of the dental enamel, can influence the path of dental caries. A fuller knowledge of these could well explain some of the perplexing phenomena of clinical dental caries.

Developmental Opaque Areas and Hypoplasia of Teeth

*Robert Harris, M.D.S.**

Introduction.

During the course of examinations of numbers of children in the United Dental Hospital, Sydney, the opportunity was taken to observe the prevalence of opaque areas and minor hypoplastic defects in permanent teeth.

The children in this survey were all born in the County of Cumberland and all teeth recorded in the main survey are exclusive of any from the mouths of children afflicted with gross enamel dystrophies.

Since two surveys[1, 2] made within this State indicate that the community drinking water supplied to these children is without fluorides, it can be concluded that the opacities and hypoplastic defects cannot be attributed to fluoride as a possible source.

Black[3] defines mottled enamel as an endemic deformity distinguished especially by the absence of the cementing substance between the enamel rods in the outer fourth more or less of the enamel and presenting great variety of colour. In certain regions of comparatively few square miles, many thousands of persons have this deformity. The essential features in this definition, when considered from a clinical view, are (1) the condition is endemic, (2) there is a variety of colour and (3) many individuals are affected.

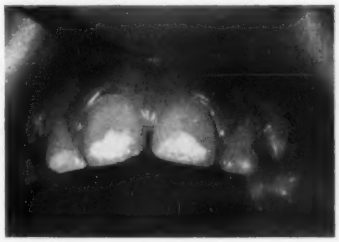

Fig. 1.—A photograph of the upper central incisor teeth on which there are large opaque white areas.

Furthermore, Black refers (loc. cit.) to white spots in the enamel. This deformity is paper white, "not very frequent and many of them are passed over without observation." This is a rather loose expression, if not conflicting.

McKay, writing in Black's work (op. cit.) refers to the

"constant misconception in the understanding and use of the term mottled; hence it is important to point out that this term applies exclusively to the grayish white or blotched appearance of the enamel and even includes the dead white phase and does not refer to the brown discolouration nor the corroded type."

McKay does not adhere to his definition, for many examples illustrated as mottled enamel demonstrate dark discolouration and corroded areas.

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Method of Observation.

The population group is not restricted to any one social strata since numbers of patients observed in the Department of Preventive Dentistry have been referred for consultation by private practitioners. On the other hand, the sample may not be truly representative of the child population of the Sydney Metropolitan Area, since the material was confined to those patients actually attending the Department for treatment. With this limitation in mind, this brief report is presented.

In the cases studied, there appears to be no definite pattern as to the teeth involved. Some show the defect on corresponding teeth in the one arch, others have the defect in opposing arches. Yet another modification observed is that of bilaterally opposed teeth such as an upper left molar and a lower right molar being affected. All cases recorded have been observed for more than two years and no disappearance of the zones have been noted in any discolouration.

In the younger age groups the teeth were noted during the eruptive stages. Some unerupted teeth have been observed with a mottled type of defect (the teeth — upper third molars were removed prior to the insertion of dentures).

Since the material for the survey comes from mouths of children born and living in the non-fluoride Metropolitan Area of Sydney, and, further, since these teeth have a wide range of defect, it can be reasonably assumed that many factors must be operating (cf. Sarnat and Schour[4]), for none of these children with the condition had any marked history of illness different from those whose mouths were free of the defect. Some of the defects are aesthetically disturbing. An example of this is shown in Fig. 1. It will be appreciated that whilst in this example the opacity is white, in many of those observed it ranged through white, yellow to brown. The zone of opacity, when small, has the same dense glistening surface of normal enamel, is more intense centrally and is more or less clearly demarcated from the surrounding

Table I

Total Number of Teeth in 481 Patients

Age	No. of Patients	Affected Patients	Missing Permanent Teeth	Existing Permanent Teeth	Total Teeth
6	52	21	—	194	194
7	62	17	3	561	564
8	44	23	26	403	429
9	60	20	21	882	903
10	57	20	40	969	1,009
11	63	29	47	1,385	1,432
12	48	8	54	1,170	1,224
13	51	20	75	1,241	1,316
14	44	18	122	1,120	1,242
	481	176	388	7,925	8,313

Table II

Opaque Areas and Hypoplasia

Age	Opaque Areas				Ridged				Pitted				Pitted and Ridged Enamel Defects				To tal
	Upper		Lower		Upper		Lower		Upper		Lower		Upper		Lower		
	Ant.	Post.	Ant.	Post.	Ant.	Post.	Ant.	Post.	Ant.	Post.	Ant.	Post.	Ant.	Post.	Ant.	Post.	
6	4	21	4 (1)	19	2	3	—	2	—	2	3(1)	2	—	—	—	—	62
7	15	13(2)	10	15	—	—	—	—	2	3(2)	—	—	—	—	—	—	58
8	11(1)	24	7	21	6(1)	4	3	—	3	3	—	—	2	2	3	3	92
9	14(2)	18	9	17	4	—	—	—	6(2)	—	—	—	—	—	—	—	68
10	10	14	2(2)	16	—	—	—	—	4	—	6(2)	—	—	—	—	—	52
11	21(3)	32	8	29	11(2)	—	8	—	4	—	4	—	1(1)	—	—	—	118
12	6	5	6	5	—	—	1	—	1	—	—	1	—	—	—	—	25
13	12	22	12	13	—	—	—	—	—	—	—	—	—	—	—	4	63
14	22(2)	30	12	27	6(2)	—	10	—	4	2	2	1	—	—	—	1	117
	115(8)	179(2)	70(3)	162	29	7	22	2	24	10	15	4	3	2	3	8	655

N.B. Number in brackets indicates teeth with one or more defects, so that thirteen teeth in the opacities group also had some other defect.

structures; when large, the surface was sometimes found to be pitted centrally. Such conditions have been listed separately (cf. Hurme[5]).

Frisch[6] records in Salida, Colorado (where fluorine exists naturally at 2 ppm.) that the incidence of fluorosis was high — 90.3 per cent. but in a fluoride-free area, Union Grove, Wisconsin, 15.2 per cent. showed some form of discolouration. Hurme, in his New Haven Study (op. cit.) gives a figure of 83.5 per cent.

Care has been taken to delete from the group some twenty patients who may be classified as examples of odontogenesis emperfecta, in which each patient was affected with a generalised disturbance of the enamel. In these cases there was a marked quantitative deficiency of the enamel and in seven, familial relationships were apparent. Cases A and B were a brother and sister, cases C and D brother and sister, cases E and F brothers, case G had normal brothers and sisters, but hereditary factors were found as far back as great-grandmother and grand aunts and aunts. No examples comparable with those recorded by Gustafson et alii[7] have been observed. Since these cases do not form part of this survey, no further discussion will be devoted to them.

Material.

The observations were made in the mouth in good natural light, the teeth having first been cleaned. The interval between the first and second observation was at least two years and no record was obtained where any discoloured area had disappeared.

The recorded observations are listed in Tables I and II.

It will be noted from Table I that the numbers of patients examined in this survey and missing teeth have been listed as well as existing permanent teeth. It cannot be assumed that any of the missing teeth were afflicted in any way, although this may have occurred since the bulk of the missing teeth are upper and lower molars.

The number of persons affected with one or more opaque areas is 176, giving a prevalence of 36.5 per cent. If the existing teeth are taken alone, then the total number of affected teeth — 642 — from Table II shows a prevalence of the affliction as 8.1 per cent. of all teeth observed in this group.

Analysis of Table II gives the following figures:

Opaque Areas

	Upper		Lower		
	Ant.	Post.	Ant.	Post.	Total
Teeth	115	179	70	162	526
Percentage of affected teeth	17.9	26.3	10.9	25.3	81.9

Hypoplasia

(Ridged, Pitted and Combined)

	Upper		Lower		
	Ant.	Post.	Ant.	Post.	Total
Teeth	48	17	37	14	116
Percentage of affected teeth	7.4	2.6	5.7	2.1	17.7

COMMENTS.

Considerably more defects appear in the refractive index of the enamel ("opacities") than in any quantitative loss. In one case with rather thin upper incisors, a lingual discolouration, approximately conforming to the pattern of the labial areas, was present. This was noted by reflected light and in order to prevent error, the lip was kept over the labial of the teeth.

In view of the possibility of fluoridation of community drinking water as a means of reduction of dental caries and of the known effects of waters where the concentration of fluorides is such that it has been demonstrated as causing an observable effect, it is felt that this report is useful in showing that a form of opacity and mild hypoplasia can be demonstrated in a given community where there is no fluoride in that community's drinking water.

It seems essential in any preliminary survey where fluoridation is proposed, that this factor be assessed in considerably greater detail than in this report.

SUMMARY.

Observations as to mild hypoplasia in the teeth of 481 children in the age group 6-14 years, born and living in a fluoride-free drinking water area, demonstrated that 36.5 per cent. have some form of opacity and mild enamel defects.

Acknowledgment is made to the Superintendent, United Dental Hospital of Sydney, C. C. Croker, B.D.S., for permission to use the material in this report.

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Case Report

A Deciduous Supernumerary Upper Central Incisor

*A. C. Gabriel**

The presence of this supernumerary upper central incisor is of more than usual interest as the patient is now adult and the temporary dentition has been succeeded by normal permanent teeth arranged in a well formed dental arch without any diastema.

Fig. 1.—Palatal view of upper arch.

Figs. 1 and 2 show palatal and anterior views of a cast of the upper temporary teeth and first permanent molars. The three first incisors are all well formed within a wide symmetrical arch, except that the median one appears slightly smaller and somewhat

Fig. 2.—Anterior view of upper arch.

rotated. Insufficient detail exists on the cast to determine whether this is a right or left tooth. The cast was made eighteen years ago when the patient, a female, was eight years of age.

The deciduous teeth were caries free and were either shed naturally, or removed when they became loose.

The succeeding permanent incisors are not large teeth.

Neither parent has been able to trace any similar abnormality in their families, but of course such a condition could readily pass unobserved.

* Department of Anatomy, University of Sydney.

Clinical Afternoon

UNITED DENTAL HOSPITAL OF SYDNEY

Through the courtesy of the Board of Control of the United Dental Hospital, the first of a series of Clinical Afternoons was held at the Hospital on April 15th, 1954. In opening the proceedings the superintendent, Mr. C. C. Croker, expressed his pleasure that it had been found possible to implement this project (which has been sponsored by the Staff Dentists' Association of the Hospital) and expressed the hope that from this initial session, a worthwhile series would flow, for he was certain that there was more than adequate material available in the Hospital's records and special departments for many such occasions.

The demonstrations were given by staff clinicians; treatment planning and methods were presented, supplemented, where necessary, by patient presentation. The theme of the presentation dealt with the value of oral surgery as an adjunct to treatment in operative dentistry and orthodontics.

APICOECTOMY.

Clinician: G. Buchanan, M.D.S.

The rationale and general principles of the operative technique were presented and discussed. Radiographic evidence was shown demonstrating the changes which follow the procedure. It was stressed that careful selection of an appropriate technique is important and several examples were shown where inadequate root resection was the apparent cause for further surgical intervention.

The following indications for apicoectomy were suggested — extensive destruction of the periodontal membrane and bone in the periapical region, inability to obtain a negative bacteriological report for the canal, presence of a foreign body in the apical region of the canal and the existence of an anatomical form of the canal which prevents a mechanical approach to the apical third for preparation and root filling.

Contra-indications for the procedure were laid down as — extensive bone loss, general systemic disease, the age of the patient being more than 45 years or the tooth not being fully calcified. In the last instance it is not only the factor of the root canal being patent that is important, but also that the slender structure of the tooth gives rise to the danger of the root's splitting during the severing of the root. The choice of a tooth is also governed by accessibility and it cannot be a recommended procedure therefore in molars and bicuspids.

When anaesthetising the tissue care should be taken to avoid injecting excess solution sub-periostically and to remember the proximity of the nasal floor in the upper incisor region.

The removal of sufficient of the apex in order to gain access to any necrotic tissue on the palatal or lingual aspect of the root was emphasised. Failure to remove this may lead to breakdown of the procedures. It should be followed by careful toilet of the cavity and penicillin and sulphanilamide powder may be dusted into the wound, the soft tissue wound being closed with nylon sutures. In cases where the tooth is loose a splint might be essential to provide stability during healing. In any case it is a wise precaution to relieve the occlusal stress from opposing teeth.

The post operative treatment suggested was the control of oedema with ice packs and the administration of suitable analgesics. Sutures are removed six to seven days after surgery, serial X-rays being obtained every three months until the cavity has been completely filled with bone. This may require up to two years.

The existence of scar tissue which occasionally arises, might necessitate excision of the scar, elevation of the muco-periosteum on either side of the excision lines and suturing with catgut. This suture is removed within 48 hours.

Examples of cases demonstrated included the following:—

Case 1.—Male, aged 18 years. Tooth: upper left lateral incisor. The tooth had been root filled ten years previously. When radiographed it was slightly loose and a soft swelling was apparent in the alveolo-buccal fold. Fig. 1 shows a series of four roentgenograms taken over a period of seven months, (a) on presentation; (b) immediately after apicoectomy, and (c) and (d) at intervals of 5 and 7 months after the operation.

Fig. 1.—Roentgenograms of a successful apicoectomy showing healing within seven months.

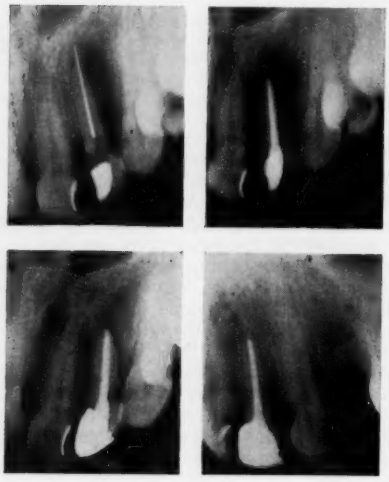

Fig. 2.—Roentgenograms of a successful removal of broken instrument by means of an apicoectomy.

Case 2.—Female, aged 15 years. Tooth: upper right lateral incisor. During the filing of the root canal, a large portion of the instrument was fractured and remained firmly in the root protruding beyond the apex for 1-2 mm. An apicoectomy was performed prior to root canal filling so that the instrument could be pushed down the canal and removed. The wound was packed with gauze, haemorrhage controlled, the canal dried with alcohol and root-filled with chloro-percha, excess being removed with a hot instrument. Fig. 2 shows a series of four roentgenograms covering a period of seventeen months—(a) at time of breaking instrument, (b) at apicoectomy and root filling, and (c) and (d) at intervals of 6 and 17 months.

Case 3.—Female, aged 13 years. Tooth: upper left central incisor. This is an example of inability to control an apical condition by medication and inadequate apicoectomy through the canal. Fig. 3 shows a series of four roentgenograms showing the various stages over a twelve month period: (a) tooth before treatment, (b) after root filling and apicoectomy (a periapical translucent zone can be seen extending coronally to the line of excision), (c) seven months after initial apicoectomy (a further 3 mm. of the root was removed) and (d) three months after the second apicoectomy.

Case 4.—Female, aged 9 years. Tooth: upper left central incisor. The tooth lost the mesial angle as a result of a blow and the pulp was exposed; subsequently an acute periapical abcess developed. A root filling and apicoectomy was carried out but no subsequent treatment had been received and within nine months the tooth had to be extracted. Fig. 4 shows a series of four roentgenograms—(a) the initial roentgenogram during operative treatment, (b) after root filling and apicoectomy and (c) and (d) intervals of three and

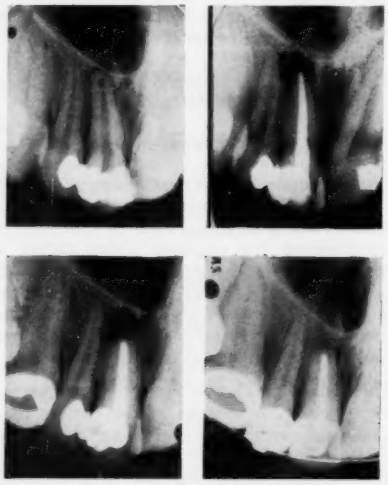

Fig. 3.—Roentgenograms of an apical lesion which healed only after a second apicoectomy.

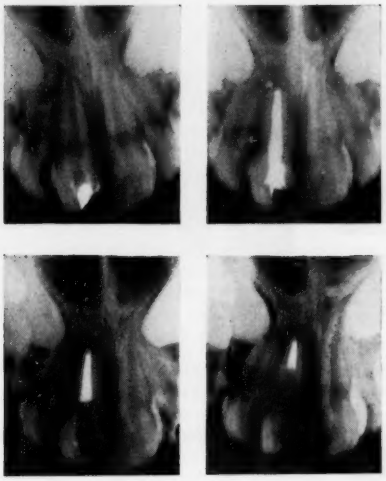

Fig. 4.—Roentgenograms of an unsuccessful apicoectomy.

six months. The case demonstrated the need for care in the selection of cases and for the insertion of an adequate restoration in the coronal portion of the tooth as a protective mechanism for both crown and the root canal and its contents.

Replantation.

Clinician: G. Buchanan, M.D.S.

Some cases of replantation were demonstrated. All, with one exception, showed marked resorption of their roots. The exception was a lower left central which was dislodged during an apicoectomy and immediately replaced with a splint support.

Roentgenograms showed that eight years after the incident there was little resorption.

Orthodontics and Oral Surgery.

Clinicians: K. Godfrey, M.D.S., and E. *Arkins, B.D.S.*

1. *Abnormal superior labial fraenum.*

The clinicians suggested that there appears to be no fixed pattern for distinguishing this condition, but there are three commonly occurring clinical features. However, these cannot be accepted as absolutely specific. The anterior component of force operating through the contact of adjoining teeth and the mesial pressure from erupting cuspid teeth may change an early apparent abnormality. An interval should elapse between recorded observations before a decision is made to undertake fraenectomy.

The three commonly occurring clinical features are:—

(a) Mid-line diastema.

(b) A connective tissue band extending from the internal surface of the superior labium in the mid-sagittal plane over the crest of bone ridge to be attached in the anterior palatine papilla area. The characteristic clinical test was demonstrated.

(c) Apparently characteristic associated bone patterns as revealed by intra-oral X-rays: often a mid-palatine sutural separation extending from an alveolar crest notch or groove, the possible path of the tissue attachment.

Cases were demonstrated in which (1) there was a coincident Class II Division 1 malocclusion, (2) a congenital absence of maxillary lateral incisor teeth, (3) a rotation of central incisors with diversion of the crown axes and (4) a relapse.

Fig. 5.—A model showing separated upper central incisors, due mainly to the absence of the lateral incisor teeth.

Fig. 5 shows a model of Case 2. Here the condition is accentuated by the absence of the permanent lateral incisors.

Fig. 6 shows models and a roentgenogram of Case 3—a child aged 12 years. Fraenectomy was subsequently followed by orthodontic therapy.

Fig. 7 shows roentgenogram of Case 4 and models before treatment and subsequent to relapse. Suture notch and separation may be noted and a definite labial fossa can be seen in the incisor region. Deep attachment of the fraenum is found in such cases.

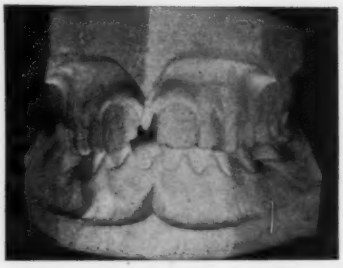

Fig. 6.—A case of widely spaced and rotated central incisors which required both orthodontic and surgical correction.

Fig. 7.—Separated upper central incisors which again became separated after treatment.

7a and 7b.—Model and roentgenogram before treatment.

7c and 7d.—Model and roentgenogram after treatment.

Fig. 8.—Eruption made possible by the removal of supernumerary teeth.

8a and 8b.—Model and roentgenogram of condition prior to surgery.

8c.—Final condition after surgery and traction.

Surgical precepts require a minimum of anaesthetic solution to avoid undue tissue distortion, complete dissection of all offending fibro-muscular tissue with a minimum exposure of bone and a maximum covering with soft tissue after surgical intervention. Support to and diminution of movement in the tissues can be obtained by applying zinc oxide adhesive tape across the upper lip immediately after operation.

2. *Supernumerary Teeth.* Sites of occurrence were discussed and reasons for surgical intervention, such as the tardy eruption of permanent teeth, mal-alignment of permanent teeth and possible loss through cystic resorption of permanent teeth roots were given.

Where a supernumerary tooth has prevented eruption of a permanent tooth, its removal and exposure of the permanent tooth may not be sufficient to allow normal eruption. In such cases vertical traction must be applied. Normal eruption cannot be expected where space for the reception of the tooth is not available. Such cases require arch realignment.

Cases were demonstrated in which (1) normal eruption, prevented by a supernumerary tooth, was attained only after vertical traction was applied to the permanent tooth, (2) supernumerary central incisors prevented eruption of the upper central incisors. The right central incisor required further stimulation (removal of bone and exposure of crown — and upper arch being applied to control space).

Fig. 8 shows models and roentgenograms of Case 1 — a child aged 11 years.

3. *Surgical exposure of incisor teeth.* The condition of retarded eruption of incisor teeth is not uncommon and is usually due to impacted supernumerary teeth which impede the progress of the permanent tooth or teeth. Treatment is usually based on surgical exposure of the crown (the wound must be packed tightly to prevent closing of soft tissue during healing). An upper arch is placed in position and light traction applied to the crown; a hook is cemented to the crown with black copper cement. *Excessive pressure is to be avoided,* otherwise the tooth may be lost.

A careful X-ray survey is required and extra-oral, as well as occlusal films, should be obtained. When in doubt, additional exposures using the phenomenon of parallax should be utilised to determine location.

4. *Impacted and unerupted cuspid teeth.* It is difficult to evaluate the influences of prenatal or congenital and local factors in determining aetiology. It was pointed out that the root apex of the unerupted cuspid should be approximately in its normal position, as shown by a roentgenogram, without too much displacement of the crown for the case to have a good prognosis. The lower cuspid is often an unsatisfactory risk.

Four cases were demonstrated.

Fig. 9.—Impaction complicated by a cystic condition.

9a.—Roentgenogram of original condition.

9b.—Roentgenogram of condition after removal of the cyst and orthodontic treatment.

5. *Impacted bicuspid teeth.* The treatment of such conditions depends entirely upon the existing tooth arrangements. Several cases were demonstrated and one in which treatment was effected by the removal of the first permanent molar teeth was shown.

The demonstration concluded with a case of dentigerous cyst in a child aged 11 years which involved the lower left cuspid and first bicuspid. Tooth alignment was considerably disturbed. Two years later orthodontic therapy was instituted.

Fig. 9 shows roentgenograms indicating progress during treatment.

—*R. Harris.*

The Treatment Of Acute Ulcerative Gingivitis or "Vincent's Infection"

G. T. Hutchinson, M.D.S. (Syd.), F.D.S., R.C.S. (Eng.)

Acute ulcerative gingivitis has a characteristic clinical appearance[1, 2]: the interproximal tissues are ulcerated in a typical punched out fashion and similar eroded, crater-like depressions may appear on the labial and lingual gingival margins. On rare occasions the ulceration may spread to the tongue and buccal mucosa. The surface of the ulcer is usually covered by a grey to greyish-yellow, loosely adherent membrane. The gingivae are intensely hyperaemic, bleeding freely and even spontaneously. Pain, caused by stimulation of nerve endings by the physico-chemical changes in the inflamed areas, is a result of the acute inflammatory reaction[3]. The patient may complain that the teeth feel as though they are being pushed apart. A metallic taste and a characteristic odour are other signs of this infection, whilst excess salivation, regional glandular enlargement and general malaise accompanied by an increase in temperature are less specific indications of the acute infection.

The clinical diagnosis may be corroborated by a bacterial smear which should demonstrate increased numbers of the typical fuso-spirochaetal group of organisms. However, this is not sufficiently specific to be relied upon as a diagnosis. A similar bacterial picture, although quantitatively different, is seen in smears taken from cases of chronic marginal gingivitis and periodontitis[4] as well as in the later stages of other oral infections. It has been suggested that a bacterial smear is not necessary for the confirmation of a diagnosis[5].

The Course of the Infection.

The acute phase of the disease tends to be self-limiting[6]. Sub-acute and chronic states have been described but since they are indistinguishable clinically, histologically and bacteriologically from sub-acute or chronic marginal gingivitis such a division does not seem to be warranted[7].

If the condition is left untreated, or if it is incorrectly treated, recurrences of the acute infection can readily occur.

Aetiology.

The aetiology of acute necrotic gingivitis requires further elucidation. The consensus of opinion appears to be that it is brought about by an active invasion of the gingival tissues by a complex group of indigenous anaerobic organisms when the resistance of the surrounding tissues is reduced[8, 9]. The causative organisms were originally believed to be fusiform bacilli and spirochaetes but latterly this group has been considerably enlarged to include a wide variety of organisms[4]. The actual role of all these organisms could only be determined effectively by their examination in pure culture—an exceedingly difficult problem.

The contention that the development of the characteristic symptoms of the infection are mainly due to an increase in the virulence of this group of organisms[10] is unproved and evidence for the suggestion that they play an active part in the tissue destruction is largely circumstantial. There is some evidence of the ability of these organisms to be transmitted through animals, causing necrotic lesions[11] and that they can give rise to typical gingival lesions in rats, particularly those suffering from an avitaminosis B[12]. Attempts to produce typical necrotic lesions in a man have failed[13], probably because the subjects were healthy and the gingivae, prior to the trauma at the time of innocluation, were normal. However, despite this lack of experimental evidence, it seems reasonable to assume that the causative agent should be some type of organism or organisms.

The determination of the systemic changes which result in reduced "tissue resistance" is an exceedingly complex problem and one not peculiar to fuso-spirochaetal infections[14]. Of the many possible systemic disturbances which may occur, acute ulcerative gingivitis appears to be more commonly associated with changes in leucocytic function similar to that in agranulocytosis, the leukaemias and in deficiencies of the B group of vitamins[12, 15]. The possibility that fatigue is a factor in the activation of latent infections[14] should not be overlooked, in fact in my experience, a history of mental distress or intense physical activity, likely to result in fatigue is often discovered. This may be a possible explanation for the increased incidence under service conditions and in the adolescent group.

Treatment.

The treatment of acute necrotic gingivitis may be considered in two phases; elimination of the acute symptoms and the returning of the gingivae to their normal form. Treatment

for the latter, neglect of which is often the reason for recurrence, requires the active application of routine prophylactic procedures.

Treatment of the acute symptoms is generally directed towards the elimination of the fuso-spirochaetal organisms as this seems to be the most rapidly effective means of controlling the acute inflammation which is responsible for the pain. Specific systemic treatment is difficult to implement since it is very difficult to determine any cause for the tissue changes. The most effective method is to alter the environment of the anaerobic organisms by carrying out an immediate oral prophylaxis and to maintain this state by early implementation of oral hygiene measures by the patient[6, 9, 16]. The area to be treated is isolated with cotton rolls, dried and a topical anaesthetic applied. Soft debris and calculus are removed and an attempt is made to clear the blocked interproximal spaces. Complete removal of calculus is not attempted, although it is surprising how much debris may be removed with negligible tissue damage by carefully using very small instruments. The rate of healing is proportional to the amount of debris removed on the first visit[9]. The dangers, often voiced, of spreading the infection do not seem to be borne out in practice.

In fact, with the possible exception of cardiac vegetations resulting from rheumatic fever, no other suitable environment for the growth of the organisms exists in the body.

A warm solution of approximately normal saline (1 teaspoon to half-pint of water) is used to forcibly flush the mouth during the debridgement and the patient is dismissed with instructions to continue this procedure at home. It is important to demonstrate an effective method of mouth rinsing to the patient.

The pain decreases rapidly as the inflammation subsides. The patient usually remarks that the pain is greatly reduced by the end of the prophylaxis, even when a topical anaesthetic has not been used. To avoid irritation to the inflamed gingivae, and to make an empirical attempt to overcome any possible vitamin deficiency the following diet programme* is suggested.

Meal Plan.

Small meals every two hours are recommended. Allow the food to cool, eat slowly and chew well.

Include a selection of the following each day:

Milk: 2-3 pints to be used as cocoa, egg-flip, junket or baked custards.

Eggs: 2 soft cooked, poached, scrambled or made into an omelette.

Meat: Soft minced meat (e.g., liver, kidney, brains) as tolerated.

or

Fish: Steamed fish.

Mild Cheese:

Cereals: Oatmeal, wheatmeal.

Fruit: At least 3 serves, especially the following when available: pawpaw, rockmelon, banana. Cooked or tinned apples, peaches or pears.

Orange or pineapple juice diluted with water may be included if it is well tolerated.

Vegetables: Potatoes, preferably cooked with skin on, tender mashed carrots, pumpkin, peas, marrow, spinach, cauliflower. Mix liberally with butter.

Cream: As desired.

Condiments: Restrict salt to that used in cooking.

Sample Menu.

Breakfast:
Oatmeal with milk.
Poached egg.
Milk or weak cool tea.

10 *a.m.*:
Milk drink.

12 *Noon*:
Scrambled egg with chopped parsley.
Ripe banana.
Cocoa.

2 *p.m.*:
Milk drink.

4 *p.m.*:
Diluted orange or pineapple juice.

6 *p.m.*:
Minced meat or steamed fish.
Potato cooked in its skin and mashed with butter.
Tender carrots. Tender peas.
Junket with stewed apple and cream.
Milk or weak cool tea.

The patient must be warned that this dietary is to be maintained only as long as directed as it is not complete in all nutrients and is obviously far from satisfactory in regard to functional stimulation.

It will be found that the acute symptoms usually will have subsided by the following day. The patient is then instructed in oral hygiene measures, which must include interproximal cleansing with suitable toothpicks. Areas in which anaerobic growth may occur are eliminated as soon as possible by a gingivectomy. In one of the few comparative studies made[17] this regime was found as effective as any method in which medication was

*Arranged with the assistance of Miss D. Lennon, Dietitian, Department of Preventive Dentistry, and The Institute of Dental Research, United Dental Hospital of Sydney.

employed. It has the added advantage that periodontal treatment and active oral hygiene measures are begun almost immediately.

Medication. A multitude of medicaments have been suggested for the alleviation of the acute symptoms. None of the claims have been based on adequately controlled evidence, an essential requirement especially when considering a condition in which the acute symptoms are self-limiting.

Antibiotics. Of all the medicaments advocated, antibiotics are the most logical, particularly penicillin and aureomycin. Numerous claims for successful treatment may be found[18, 19, 20], but few, if any, are based on controlled experiments[6] and thus the possibility of spontaneous resolution of the acute phase cannot be removed. However, antibiotics should be used as an aid to treatment in extremely severe infections. The term "aid" is used advisedly since the majority of patients in whose mouths acute infection has recurred, have reported that they had previously received antibiotic treatment. These have been cases in which the cessation of the acute symptoms has been accepted by both physician and dentist as an indication that no further treatment was necessary.

Routine administration, apart from being unnecessary, is contra-indicated for the following reasons:

i. Patients may exhibit an allergic reaction to the antibiotic which may take the form of an oedematous or erythematous local reaction. In rare cases this may be so severe that the patient may die of anaphylactic shock[21]. Such possibilities should not be dismissed as unlikely as the frequent use of antibiotics is increasing the chances of such an occurrence.

ii. Strains of organisms which resist the action of the antibiotics are becoming an increasing problem in the treatment of infection. These resistant strains develop rapidly when there is an inadequate concentration of the antibiotic—a condition commonly found when the topical application of pastilles has been used.

iii. The normal flora of the mouth is in a state of equilibrium; by eliminating susceptible organisms by the use of antibiotics this state is disturbed and an infection by the yeast-like organism Candida albicans may develop giving rise to the clinical condition of thrush. With aureomycin therapy this happens frequently enough to consider it as a calculated risk. As these infections are much more difficult to control than acute ulcerative gingivitis, antibiotic treatment should be applied logically rather than routinely.

Rosanaline Dyes. Methyl violet, gentian violet and crystal green are relatively ineffective against the fuso-spirochaetal group of organisms[22]. In fact these organisms grow quite well in quite high concentrations of methyl violet. Perhaps their great appeal depends in no small measure on their vivid demonstration of "having done something."

Chromic Acid. It has been shown that a 6 per cent. solution of chromic acid is capable of destroying normal gingivae[23] tissue and of decalcifying tooth substance[22]. The effectiveness in reducing pain claimed on its behalf is due to the fact that it destroys both tissue and nerves, thus increasing the tissue destruction.

Oxygenated Mouthwashes. It has been stated that:

> In contact with the tissues, its (hydrogen peroxide) germicidal power is very limited, owing to the fact that organic matter decomposes it. It is of value . . . because of the development of gas which tends to loosen adherent deposits[24].

Prolonged use of even diluted solutions of peroxides will result in decalcification of the teeth[24], whilst the more potent oxidants can damage the oral mucosa[25].

Summary.

1. Immediate oral prophylaxis and active oral hygiene by the patient is an effective method of treating acute ulcerative gingivitis (Vincent's Infection).
2. A short consideration of some of the weaknesses of the more favoured medications is presented.

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Chronic Osteitis And Osteomyelitis Of The Jaws*

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The majority of cases of inflammation of bones other than the jaws occur in childhood during the period of active growth. The inflammation is often suppurative in character, and is usually due to the presence of pyogenic organisms. These may be introduced into the bone by injury or by the blood stream from a distant focus of infection situated in such positions as skin, tonsils, etc. The great majority of cases of pyogenic infection of the jaws, on the other hand, present a different clinical picture. They are more common in adult life than in childhood, and most of them originate from infected teeth.

"Osteomyelitis" is defined in Dorland's medical dictionary as:

> Inflammation of the bone caused by pyogenic organisms. It may remain localised or it may spread through the bone to involve the marrow, cortex, cancellous tissue and periosteum.

"Osteitis" is described as:

> Inflammation of a bone; inflammation of the Haversian spaces, canals and their branches, and generally of the medullary cavity.

From these definitions we can see no clear-cut distinction between osteomyelitis and osteitis. In many text books also no sharp distinction is made, and from the pathological point of view any inflammation of bone which involves the medullary spaces is an osteomyelitis. This would include such conditions as diffuse periapical infection, advanced periodontal disease, and dry sockets.

From the surgical point of view, however, it has been found convenient to make a distinction and it has become conventional to apply the term osteomyelitis to cases of pyogenic bone infection which present the following features:

(1) The presence of pus.

(2) A tendency to spread.

(3) Formation of sequestra.

With the great improvement in the treatment of infectious diseases which has followed the use of the sulphonamides and antibiotics it is probable that, in countries with an efficient medical service, advanced or gross cases of osteomyelitis of the jaw and of other bones will become rare. Most of the cases met with in practice today are not extensive and have usually developed owing to faulty treatment, or to lack of treatment.

As already mentioned, the commonest cause of osteomyelitis of the jaws has always been from infected teeth. The second commonest cause is trauma, for example injuries causing fracture. Osteomyelitis of the jaws may be divided into osteomyelitis of the maxilla in

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infants and suppurative osteomyelitis of the older children and adults.

Osteomyelitis of the maxilla in infants.

This disease is an interesting clinical entity of comparative rarity. Asherson, writing in 1939, stated that only some 70 cases had found their way into the literature since the condition was first described by Rees in 1847. Other cases have been reported since 1939 but the total number is still small. The writer has treated one case which is now reported for the first time, and which is typical of other reported cases.

Case History: a male infant aged nine weeks was admitted to the Eye and Ear Hospital, Melbourne, on 25/9/42. He had been quite well until 24 hours previously when suddenly he had become restless and feverish. When seen at the hospital the right eyelids were swollen and oedematous, the eye was closed and the lids could not easily be opened, but when they were parted it was noted that considerable oedema of the ocular conjunctiva, and some degree of proptosis were present. The child had a temperature of 104 deg.

As had happened in similar cases, at this stage the condition was diagnosed as orbital cellulitis, but soon after admission a profuse discharge from the right nostril and considerable swelling of the right side of the face occurred. The correct diagnosis of osteomyelitis of the maxilla was then made, and the child was transferred to the ear, nose and throat side of the hospital. On 26/9/42 the honorary aural surgeon in whose care the infant had been placed, opened up the swelling on the lower eyelid, and made an incision in the canine fossa. There was a profuse discharge of pus from both regions. The child's temperature and swelling subsided rapidly and he was transferred to the outpatients department on 20/10/42.

At this stage the honorary surgeon who had charge of the case, resigned from the hospital and the writer was asked to take over the further care of the patient. The pyrexial stage had now passed and the chronic stage established when the child was seen on 23/10/42. The swelling had considerably diminished, but there was a free discharge of pus from fistulous openings in the right lower eyelid, canine fossa, and the right nostril. A small sequestrum on the gum in the right upper molar region was sufficiently loose to be picked out with tissue forceps. On two occacasions between 30/10/42 and 18/12/42 the infant was given a light general anaesthetic for the removal of small sequestra and the crowns of two deciduous teeth which were identified as the right canine and right second molar.

Early in February, 1943, the general condition of the patient had improved sufficiently for the area to be opened. Penicillin was not available at that period but a course of sulphathiazole was given, commencing before the operation and continuing for five days after. When the muco-periosteum was reflected back pus was found in the antrum and in the crypts of the teeth. The lateral incisor and first deciduous molar were lying loose in their crypts in a pool of pus, and were picked out. A sequestrum found near the infra-orbital margin was removed. There was a fistulous opening into the right middle meatus of the nose and this was enlarged for drainage.

During several succeeding months the infant's condition improved greatly; the discharge continued but on a considerably reduced scale, and usually from only one fistula at a time. Early in 1944, however, free discharge from the three original areas (i.e., the infra-orbital, nasal and canine fossas) recurred. A sequestrum could be palpated and a portion of it seen protruding through the gum. On 3/5/44 the area was re-opened and this sequestrum, together with three smaller ones, were removed. These appeared to have been thrown off from the lateral wall of the antrum, exposing practically the whole of this now fairly large cavity. It contained some pus and debris which was cleaned out, and the flap was returned to position without sutures. The fistulae in the mouth and infra-orbital regions did not discharge again and speedily closed. A slight discharge continued from the nose for about three weeks and then ceased. The only subsequent treatment to the jaws has been given on two occasions when two imperfectly developed teeth of the secondary dentition have come to the surface. On 6/3/46 the crown of the upper right first premolar was easily picked out, and on 17/9/47 a carious, partly erupted tooth which appeared to be the upper right first molar was extracted.

Aetiology: There has been much controversy over the causation of such infections. It has been definitely established that the initial site of the infection is not the antrum as was originally suggested, but the crypt of one of the deciduous molar teeth. It is commonly thought that the infecting organisms are transferred to the infant from the mother's nipple and enter the jaw through some lesion such as a laceration or fissure on the child's gums. It was interesting in this case to observe that the mother had a grossly septic mouth.

Suppurative osteomyelitis of the jaws of older children and adults.

Osteomyelitic conditions occurring in these different age groups are often described as separate diseases, but the writer can see little necessity for this as their pathological and clinical descriptions are very similar.

There are two points of difference—firstly, haematogenous infection involving the jaw and other bones has always been much more common in children than in adults. Secondly, unerupted teeth may be involved and may be exfoliated as in the osteomyelitis of infants.

As already mentioned, gross cases of osteomyelitis involving large areas of the jaw should be rare in the future, but the fact that seven cases of true osteomyelitis of the jaws were treated by the writer during a period of 12 months in 1951-1952 indicates that the disease must still be considered as a potential danger. A brief description of three of these cases follows.

Case 1. A male aged 32 years, living in a large provincial town, was involved in a motor accident and suffered lacerations to the face and a fractured mandible. The lacerations were repaired, but the only treatment given for the fracture was a course of systemic penicillin for about 10 days and the fitting of a four-tail bandage, which the patient wore for three weeks. Five weeks after the accident the medical practitioner who had given this treatment became alarmed at the patient's condition, and called a dentist in consultation. Within two hours the patient was on the plane for Melbourne, and the writer saw him the same afternoon.

On examination the right side of the face was found to be swollen and tender as were the submandibular and deep cervical glands of that side. The patient looked very toxic; he was pale, had a coated tongue, a temperature of 99.4 deg. and pus oozed from multiple fistulae on the gum of the lower right molar region. He complained of continuous, severe, nagging pain. Radiograms taken soon after the accident had shown an oblique fracture through the right side of the body of the mandible and the presence of a horizontally impacted third molar tooth in the line of the fracture. Films taken five weeks after the accident showed a well-established osteomyelitis around the fracture area. Impressions for a Gunning splint were taken immediately. The patient was admitted to hospital, given large doses of penicillin, and the following day the area was opened up via the oral cavity. One large and several smaller sequestra were removed, the impacted tooth carefully freed of its surrounding bone and extracted. A tube for instillation of penicillin into the wound was inserted from behind the posterior border of the ascending ramus of the jaw in the manner suggested by Fickling. Large daily doses of penicillin were given for four days, and the Gunning splint was fitted on the second day. The patient made an excellent recovery and was allowed to leave hospital on the sixth day.

Case 2. A male aged 50 years had suffered from vague discomfort in the edentulous lower left molar region since receiving a blow there with a heavy steel instrument two and a half years previously. He had not worn any lower denture prior to having his lower anterior teeth extracted a few months before he was seen by the writer in June, 1952. He had an immediate insertion of a full lower denture and soon after this the posterior part of the left side of the mandible became very sore. This was naturally thought to be a result of denture irritation and the pain eased appreciably after the denture was trimmed. However, he still suffered from intermittent attacks of a dull pain. When seen by the writer a discharging sinus was found on the gum in the lower left second molar region; there was tenderness over the buccal and lingual sides of the bone, and the submandibular glands were palpable and tender.

A radiograph was taken and showed a small osteomyelitic area with a sequestrum about the size of a pea.

Case 3. A male aged 52 years had an infected upper left anterior tooth extracted about six years previously. He was not conscious of any trouble till four years later when the area became swollen and there was a discharge of evil smelling pus. He was given penicillin systemically and it was also instilled into the area. The pain and swelling eased but the patient stated that there had been intermittent swelling and discharge of pus during the following two years. He developed arthritis and was referred to the writer for an opinion as to the relationship of the two conditions and for any necessary treatment of the jaw. On examination, irregularity of the bone in the upper left incisor-cuspid area was found. A slight depression could be felt and pus exuded from two fistulous openings on the gum. At operation a large mass of fibrous tissue was found beneath the muco-periosteum. This occupied part of a large cavity which also contained granulation tissue, pus and two small sequestra.

Localised Osteitis.

All diffuse periapical infections and all advanced cases of periodontal disease are

examples of a localised osteitis. These are usually easy to diagnose if a careful clinical examination is made and good radiographs obtained. These will not be discussed further except to mention that, in the writer's opinion the infected areas of bone in many of these conditions should be curetted at the time when the teeth are extracted. In the pre-antibiotic era this was sometimes a dangerous procedure but with adequate antibiotic coverage it may be done safely, and prevents the risk of "residual infection." Nor shall we discuss those cases in which a small localised collection of pus is found in a cavity in the jaw bone. It is a fine point whether or not these should be considered as a localised form of osteomyelitis. They have often been described as such, although many of them show little tendency to spread and there may be no sequestrum formation.

The non-suppurative type of osteitis will be discussed here. It is certain that such conditions are quite common but that they often remain undiagnosed. The condition is often referred to as "residual infection" although it is probable that in some cases injury to the bone, and not infected teeth, has been the primary cause.

The clinical signs of the condition may be an irregular outline of the bone, sometimes a depression, or alternatively some degree of swelling.

The radiographic signs are usually rarefaction or sometimes, condensation of bone. Occasionally both occur. Root fragments in relation to the areas of bony changes may be present.

Most cases present some of the following symptoms:—Pain, sometimes of a neuralgic character, slight tenderness, especially on pressure or just a vague discomfort from pressure of a denture. Chronic tiredness "feeling below par," inability to concentrate or headache is often experienced.

Briefly stated, the treatment of these conditions is to open up the area, curette out the infected bone and trim the remaining bone to a smooth surface. This is done under an antibiotic cover and often can be carried out with local anaesthesia.

Pathology.

The rarefaction of the bone is usually apparent at operation and sometimes large masses of chronic inflammatory granulation or fibrous tissue are found in the bone. In other cases they are present in small amounts in the enlarged marrow spaces of the cancellous part of the bone. Attempts by the writer to decalcify and section specimens from some of the latter types have not been very satisfactory because in most cases the soft tissue, though visible with a hand lens before sectioning, has not remained in situ during the process of decalcification. However, the following points have been confirmed microscopically.

(a) The rarefaction of the bone.

(b) The absence of normal marrow space contents.

(c) The presence (in some cases) of inflammatory soft tissue.

In conclusion, the writer believes that the failure to recognise and treat conditions of this nature has been one of several reasons why the theory of focal infection has lost its popularity. No one wishes for a return of the exaggerated claims which were made for focal infection 30 years ago but there has developed an unfortunate belief by some members of the medical profession that infective conditions about the mouth and jaws produce little or no ill-effect on other parts of the body. The writer believes that few if any members of the dental profession share this belief.

Let us all be more diligent in our search for such lesions, and in their complete eradication when they are discovered.

Fellowship in Dental Surgery, Royal College of Surgeons of England

J. F. Reading, B.D.S. (Syd.), F.D.S., R.C.S. (Eng.)

"I wish to express the hope," wrote a correspondent in a letter to the British Dental Journal in 1945, "that the requirements for the granting of this diploma (the Fellowship in Dental Surgery of the Royal College of Surgeons of England) will be based essentially on practical skill rather than on academic progress . . . . Looking further ahead one would hope to see a comprehensive scheme of advanced postgraduate work associated with the new diploma. This would seem opportune if as we hope, financial support is to be given for postgraduate dental surgery in the same way as the Minister of Health stated recently is to be given by the State to medical postgraduate education."

This was one of many letters that filled the Journal following the announcement that, after more than 50 years' consideration, the new diploma of F.D.S.R.C.S. was at last to be instituted.

In 1938, the "Lancet" announced that the Council of the Royal College had given sympathetic attention to the suggestion that a higher dental diploma by the College would be welcomed. They suggested the title of Master Surgeon Dentist, but the award of such a diploma was not permitted under the existing charter and therefore the establishment of a supplemental charter was necessary. This fact had been recognised 30 years after the institution in 1860 of the Licence in Dental Surgery of the college, but when it was found that it would be necessary to amend the charter of the college in order to give effect to the establishment of an honours qualification no action was taken.

In 1911, after dental degrees had been instituted by some of the universities, a proposal was made that the royal colleges should be asked to institute a Dental Fellowship, and shortly after the 1914-1918 war, the Higher Dental Diplomas (H.D.D.) were instituted by the Royal College of Surgeons in Edinburgh and by the Royal Faculty of Physicians and Surgeons in Glasgow.

It was not till near the end of the Second World War that steps were taken to obtain a supplemental charter, which, in addition to giving power to co-opt additional members of the Council to conduct a special final fellowship examination in opthalmology and otolaryngology, allowed the establishment of a fellowship in dental surgery.

The desire of the council of the college was that the conditions governing the granting of of the Fellowship in Dental Surgery would be as similar as possible to those governing the existing Fellowship of the College.

On 20th May, 1947, the supplemental charter was granted and the Faculty of Dental Surgery came into being. This was the first Faculty to be created in the College and it comprised the newly elected fellows and the licentiates in dental surgery. The Faculty was founded because it was felt desirable to foster and develop further the collaboration between dental surgery and surgery in general and to encourage the Hunterian ideals in dental surgery. The objects of the Faculty were stated to be:—

(a) to advance the science and art of dental surgery;

(b) to encourage study and research in the field of dental surgery and cognate subjects.

In the annual report of 1948 of the college it was explained that

> although it is not a requirement of the College that candidates for the Fellowship in Dental Surgery should hold a medical or surgical qualification it is the policy of the Board to ensure that those who are admitted to the Fellowship shall possess a knowledge of Anatomy, Physiology, Pathology and General Surgery which though specialised shall be wide enough to make them thoroughly conversant with the application of these subjects to the practice of dental surgery in all its branches.

The British Dental Journal of the time expressed the hope that "the examination for the new Fellowship may do much to stimulate the study of special problems of dental surgery such as for instance those of physiology and pathology of dental tissues."

The Fellowship could not have had a more favourable inauguration than the announcement in 1949 that the Right Honorable Viscount Nuffield had made a magnificent gift of £250,000 for the erection of a residential college to be known as the Nuffield College of Surgical Sciences. (This is the greatest single gift ever received by the College.)

Since the first examinations were held in April 1948, 139 candidates have been awarded the Fellowship in addition to certain elected members, as the regulations permitted the conferring of diplomas, without examination, on a limited number of dental surgeons (250) in the first three years after the granting of the supplemental charter, and thereafter on not more than two persons a year.

Examinations for the Fellowship.

In the annual report for 1953 it was stated that in the past year, 100 candidates had presented themselves for the primary examinations and 55 had been successful. In the final examinations 34 passed out of 71 candidates.

In the first primary examination in April, 1948, candidates were asked such questions as:—

Give an account of the lateral wall of the nasal cavity including its blood supply, lymphatic drainage, and its nerve supply.

Describe the growth of the mandible from birth to adult life.

"Co-ordination of successive reflexes is achieved by orderly sequence." Illustrate this by the mechanical process of digestion.

Discuss the mechanism of tooth eruption and state how it may be affected by general disorders.

The written papers for the first final examination posed problems such as:

A patient presents with a hard painless swelling of the mandible extending from the second premolar to the third molar. A radiograph of the area suggests a polycystic condition. How would you proceed to make a diagnosis?

Discuss the oral manifestations of vitamin deficiencies.

The candidate was allowed three hours for three questions all of which were compulsory.

The questions however changed in character as the examination progressed. In 1949 candidates were asked in the primary:

What are the effects of breathing each of the following gases (a) pure N_2; (b) pure O_2; (c) 5% CO_2 in air; (d) 9% CO_2 in air and (e) 1% CO in air?

What are isohaemagglutins? Discuss their importance in blood transfusion.

Discuss the physiological factors which influence the development and calcification of enamel.

The Primary Examination.

There are two examinations a year, in April and October, composed of written papers and oral examinations in (a) applied Anatomy, including the anatomy and histology of the teeth and jaws and (b) applied Physiology and the principles of Pathology of importance in dental surgery.

The examination consists of two papers of three hours each on the above subjects, and two oral examinations of 30 minutes' duration which consist of 10 minutes examining slides under a microscope and 10 minutes questioning by each of the two examiners. Results are announced on the same day as the completion of the last oral examination.

In preparation for the primary examination, the Royal College of Surgeons conducts a course of eight weeks' duration in the basic sciences of anatomy, physiology, pathology and dental anatomy. This includes the allied subjects of histology, bacteriology and dental pathology, all of which are included in the scope of the examination. More accurately this course, while held in the premises of the college and given mainly by lecturers of the college, is prepared by the Institute of Basic Medical Sciences, which is part of the University of London just as the teaching side of the Eastman Dental Hospital is known as the Institute of Dental Surgery.

In Anatomy one is required to possess a knowledge of the "development and topographical anatomy of the head and neck with special reference to applications to dental practice. The topographical anatomy of the thorax and abdomen sufficient for the understanding of physiological processes and disease. The evolution, development, macroscopic and microscopic structure of the dental tissues. Comparative anatomy illustrative of the evolution of the dentition and adaption to function." Twenty lectures are given each one covering one particular region such as for example, the larynx, with special reference to the anatomical aspects of phonation and deglutition. Histology is revised by a series of slides and a short talk before the main lecture commences. Fourteen practical demonstrations on cadavers are given.

The physiology course covers the "principles of human physiology with special reference to the development, calcification, growth metabolism and nutrition. Function, growth and retrogressive changes in the teeth and jaws. Influence of heredity, endrocrine system, diet and metabolism on the teeth and jaws. Salivary glands and saliva. Mastication, deglution, taste, phonation and articulation."

More time is devoted to physiology than to any other subject in the course, and the lectures are of a high standard giving one concept of the importance of physiology to the dental surgeon.

The lectures in pathology include "the principles of pathology and bacteriology, including inflammation, fever, immunity, infection, repair, disturbances in metabolism, growth and body fluids, local and somatic death, diseases due to bacterial infection, viruses and neoplasia." An understanding of the principles of pathology seems more desired than a detailed knowledge of specific diseases. For most Sydney graduates this course would be a useful revision.

Dental anatomy is presented in great detail by both lectures and histological demonstrations illustrating the internal structure of the teeth and the supporting tissues. Special demonstrations of anatomical and pathological specimens are arranged, and the resources of the large museums and the library of the college are at the disposal of the students.

Hospital Appointments.

The regulations dealing with requirements for the Final Examination state that:—

"Candidates who have passed the primary examination are admissible to the examination on the production of evidence of:—
(a) Having been engaged in the acquirement of professional knowledge for not less than two years subsequent to the date of having obtained a qualification recognised by the Council as specified in paragraph 1 of the General Regulations.
(b) Having held for not less than six months a whole-time hospital appointment or appointments approved by the Council for the purpose."

The dental appointments may be held at the dental hospitals associated with these Universities and Colleges whose degrees in dental surgery are recognised in Great Britain and certain other hospitals selected by the Board for the purpose. There are opportunities for those interested in particular branches of dentistry to further their training in those fields, for example, those desiring to carry out further study in oral surgery, may become attached to one of the various maxillo-facial units at East Grinstead, Basingstoke, Mount Vernon; or those interested in children's work, including surgery of the cleft palate and orthodontics, may go to the Hospital for Sick Children, Great Ormond Street. Whilst these opportunities exist, there is a keen demand for them and it is difficult to gain an appointment. Generally applicants already possess the F.D.S.R.C.S. or an equivalent higher qualification. However there are many other hospitals, which, while not so well known, offer almost better opportunities during the six month's internship as the appointee is assured of doing a large amount of the work himself, rather than watching or assisting a senior dental surgeon. For those students seeking a general course in advanced dental procedures in the major subjects, the Institute of Dental Surgery at the Eastman Dental Hospital, London, conducts courses of eight months' duration in preparation for the final examination. In each course, several junior clinical assistantships are awarded which are appointments enabling students to receive a stipend during their course. As these positions are necessarily limited, the other students must pay fees for the period of instruction at the Institute.

The Short Course for the Final Fellowship Examination.

For those interested in gaining an insight into English dentistry without necessarily reading for the dental fellowship, the course conducted jointly by the Royal College of Surgeons and the Institute of Dental Surgery can be thoroughly recommended. It will take him into general hospitals for lectures, demonstrations and ward rounds on such topics as "surgical emergencies — cause and treatment," "skin infections of the head and neck," "E.N.T. conditions in relation to dentistry" or "lymphatic glandular enlargements." Day excursions are arranged to the maxillo-facial units at East Grinstead and Mount Vernon. These visits also consist of lectures, tutorials and looking in on plastic operations. Six lectures a week are given in the evenings at the college on particular dental conditions by such people as Professor M. A. Ruston, Wilfred Fish, Kelsey Fry, Professor F. C. Wilkinson and Professor R. V. Bradlaw. The subjects vary each year but cover such subjects as soft tissue infection of the head and neck, minor plastic surgery in dentistry, disorders of the tempero-mandibular joint, the blood examination in dentistry, cervical lymph nodes and cleft palates.

Much time is spent at the Eastman Dental Hospital where extensive courses are arranged in the main clinical subjects, including demonstrations and practice on technique "phantom heads" and in the mouth. A most popular feature is the teaching clinics held once a week. These are arranged by the Institute but conducted by surgeons or medical and dental specialists from other hospitals. Each demonstrator brings to his session patients exhibiting, as far as possible, lesions on the head and neck, and certain conditions in the thorax, abdomen and limbs, which are connected with lesions which may more properly be the concern of the dental surgeon. In this manner, a far wider variety of cases than would normally pass through the Institute and the adjoining general hospital is available to the postgraduate students. For these clinical sessions members of the course are divided into groups each of whom examines a patient and draws his conclusions. Afterwards there is a discussion of the condition, its diagnosis and treatment. After a given period of time, the group moves on to the next demonstrator and his patients. Usually 8 to 12 patients are examined in the afternoon. This is one of the most popular and valuable features of the whole course.

The Final Examination.

This is held twice yearly, usually in January and July. The subjects of the examination are surgery, oral pathology and bacteriology, and dental surgery. The examination in surgery is partly oral and partly clinical, whilst the examination in oral pathology and bacteriology and dental surgery is partly written, partly oral and partly clinical and includes the examination of patients and operative dental surgery. In practice this means:—

(1) A written paper (three hours).

(2) Operative dental surgery (one half day).

(3) General surgery clinical examination (20 minutes).

(4) General surgery oral examination (10 minutes).

(5) Dental surgery clinical (30 minutes).

(6) Dental surgery and pathology

(a) pathology

i. microscopic examinations of slides (10 minutes).

ii. oral examination (15 minutes).

(b) dental surgery oral examination (15 minutes).

The written paper for the final examination includes questions on dental surgery including oral pathology and bacteriology. Generally three compulsory questions are set and three hours are allowed for the examination.

The operative dental surgery examination has required in the past either the surgical removal of an impacted tooth, preparation of a tooth for a jacket crown or an inlay, the extra-oral radiographic examination of patients or a similar task. The actual task is balloted for and is announced just prior to the examination.

The general surgery clinical examination is held in two "wards" at the examination hall, Queen Square, one having typical in-patients and the other all manner of ambulatory patients. The candidate has five minutes to examine one of the in-patients in detail, to give an account of what he sees and to give a provisional diagnosis and treatment plan. The remaining 15 minutes are spent largely on spot diagnoses of such conditions as winged scapula, acromegaly and Paget's disease.

The oral examination in general surgery is conducted with the use of dissected specimens and consists of a discussion and questioning on general surgical principles rather than on specific general surgical techniques.

In the clinical examination in dental surgery, the candidate has 15 minutes to examine one or more patients. He is at liberty to make as complete an examination as he considers necessary and to make notes. In the remaining quarter of an hour he is examined by two examiners concerning the case and any aspect of dental surgery may be introduced.

The final test is divided into three sections run consecutively. Candidates firstly have two or three slides of pathological conditions to examine in 10 minutes, writing a description of what they see and giving a diagnosis. For the next 15 minutes they are examined on the subjects of the slides and also, with the use of x-rays and dissected specimens, on general pathological conditions. The final 15 minutes on dental surgery again may include any subject such as the clinical diagnosis and treatment of "clicking jaws," or the bacteriology and treatment of Vincent's infection.

Results are announced on the same day as the last examination and students are immediately admitted to the Fellowship which is officially confirmed only if they have attained the age of twenty-five years and paid the prescribed diploma fee.

Fees.

The following fees are charged:—

Primary fellowship course	£31	10	0
Primary examination fee	£ 8	8	0
Final examination course (8 wks.)	£31	10	0
Final examination fee	£15	15	0
Diploma fee	£21	0	0
	£108	3	0

Institute of Dental Surgery

Final Course (8 months)	£60	0	0
(which includes payment of fees for the College courses).			
Total Minimum Outlay	£45	3	0
(Primary and Final Examination and Diploma Fees).			

Regulations in Brief.

The candidate must

(a) possess a dental qualification registrable in the British Dentists Register,

(b) have attained the age of twenty-five years (the candidate can sit for the final examination before he is this age),

(c) have sent in his application for the primary examination 21 days beforehand and for the final 35 days,

(d) have been engaged in the acquirement of professional knowledge for not less than two years subsequent to the date of having a qualification as above, and

(e) have held for not less than six months a whole-time hospital appointment.

Information and Application Forms.

Royal College of Surgeons: The Secretary, Faculty of Dental Surgery, Royal College of Surgeons, Lincoln's-Inn-Fields, London, W.C.2.

Institute of Dental Surgery: Professor F. C. Wilkinson, Eastman Dental Hospital, Gray's Inn Road, London, W.C.1.

Application Forms and Regulations: The Examination Secretary, Examination House, Queen Square, London, W.C.1.

Current Intra-Oral Roentgenographic Techniques

A Critical Evaluation.

*E. J. Barton, B.D.S.**
A. H. Wuehrmann, D.M.D.†

Since the early days of radiological development, it has been recognised that roentgen rays and visible light possess many common properties. Unlike early experimenters in medical diagnostic procedures, the dental investigators chose to ignore some of these principles as they relate to image formation and, for reasons of convenience, developed techniques which were not without merit. Of recent years, the trend in dental roentgenology has reverted to the more fundamental concepts of image projection[1, 2, 3, 4, 5, 6, 7]. With this in view, an historical and analytical review of the technical development in intra-oral roentgenology seems opportune.

Advancement of the techniques in the dental profession during the early decades following Roentgen's discovery was severely limited by the equipment and film available. The general trend was towards the adoption of a technique incorporating the "Rule of Isometry" as proposed by Cieszynski (1907)[8] and later modified by the addition of supplementary bitewing films as advocated by Raper (1925)[9]. With only slight changes, these procedures were accepted by the profession and are still used by the majority of dental practitioners. In general, the principles of this technique are based upon symmetry of a geometric nature which is not applicable to a third dimension. This is especially true in view of the short target-to-film distance and the resultant wide divergence of the rays. A distortion of the coronal portions of the tooth and its associated structures necessitates the use of the bitewing films. The technique now gaining prestige is based on the principles of accurate object reproduction, minimising distortion (elongation and foreshortening) and maintaining detail at least at a quality level equal to that of earlier techniques. Credit for the original application of the paralleling technique goes to McCormick[10], who in 1920 advocated and used the procedure. It was impracticable for the average dental practitioner because of technical limitations and failed to be put into general use.

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†Professor of Dentistry—University of Alabama, School of Dentistry.

Since roentgen rays possess photo-metric properties similar to visible light the application of the principles of shadow formation is of paramount importance if the resultant image on the roentgenogram is to be a true reproduction of the original object. These principles are as follows: (1) the rays should originate from the smallest possible point source; (2) the source of radiation should be as far as is practicable from the object; (3) the proximity of the object to the film should be minimal; (4) the film and the object should be parallel and (5) the rays should strike the object and film at right angles. Of these, only the first is ordinarily out of the operator's control. The application of these principles will be discussed in the sequence given below.

(1) Small and large focal spots may be compared to a single light globe and a chandelier. Multiple light sources create multiple images the edges of which are not superimposed.

(2) If the source of radiation, regardless of size, is withdrawn from the object and recording surface is maintained, the borders of the multiple shadows tend to coincide more nearly.

(3) If the distance between the object and the recording surface is decreased and that between the source and object maintained, the tendency for superimposition of the multiple borders becomes greater. The combination of the effects of No. 2 and No. 3 can be demonstrated by the changes in the shadow of a hand cast on a white table cover by a light source as the hand is raised or lowered. Thus we can demonstrate that the detail of a film is maximum when the source is small, the source-to-object distance great and the object-to-film distance, minimal. For the sake of completeness, it should also be pointed out that the factors which affect detail also directly affect magnification. This is not to be confused with elongation and foreshortening. Magnification is increased when the target-to-object distance is decreased or when the object-to-film distance is increased even though the radiation source be a single point infinitely small. When multiple light sources are used, the image produced by each source is magnified.

(4) Failure to parallel the film and object, with the radiation perpendicular to the object, causes elongation (Fig. 1). Failure to parallel the film and object with the radiation perpendicular to the film, causes elongation followed by foreshortening as the angulation is increased (Fig. 2).

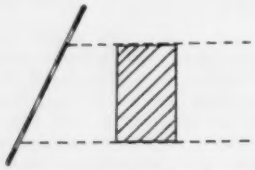

Fig. 1.—Image elongation when object and film are not parallel and rays are at 90 deg. to the object.

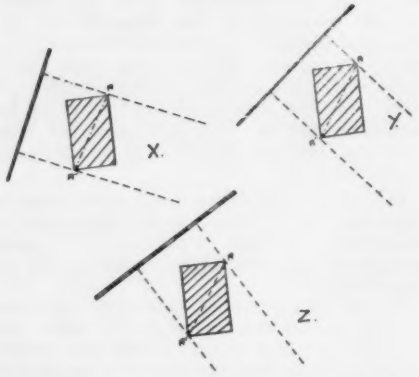

Fig. 2.—When the rays are at 90 deg. to the film but not to the object, elongation of the image increases (X) until the rays become perpendicular to the greatest dimension of the object (AA^1); thereafter reduction of the greatest dimension results (Y) and ultimately foreshortening of the entire image (Z).

(5) If the film and object are made parallel without the ray being perpendicular to both, elongation of the shadow results and it becomes larger as the angle is increased provided that parallelism of film and object is maintained (Fig. 3).

Since the procedure of using a short cone and bisecting the angle between the film and object are well known, no attempt will be made to discuss this technique. The comments to follow will relate the methods embodied in the technique to the principles already cited, thus making evident its advantages and faults.

(I) Obviously, the operator has no control over the size of the radiation source (focal spot size).

(II) An eight inch target-to-film distance is used. The use of rays which are widely divergent from the central ray emphasises magnification (Fig. 4) and prevents optimum detail by increasing the size of the penumbra (Fig. 5).

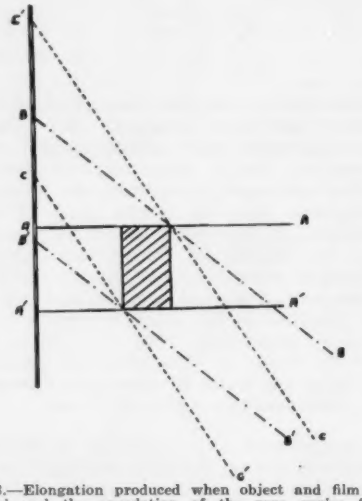

Fig. 3.—Elongation produced when object and film are parallel and the angulation of the rays varies from the perpendicular.

Fig. 4.—Increased magnification of the image as the target-object distance is decreased, $X:X^1=Y:Y^1$.

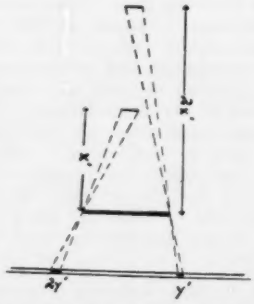

Fig. 5.—The degree of penumbra formation to be related to the target-object distance, $2X:X=2Y:Y$. Penumbra formation is impossible from a point source.

(III) The film is in contact with the crown of the tooth but varies in distance from the root of the tooth because of curvature of the palate. The apex-to-film distance is approximately ¾ inch. The object-to-film distance can never be reduced, thus, the loss of detail and production of magnification is minimal for these anatomical conditions.

(IV) The object and film are not parallel. The central ray goes through the tooth apex and is perpendicular to a line bisecting the angle formed by the tooth and the film. Thus, geometrically similar triangles are created at this point, but it must be remembered that only the central ray is perpendicular to the bisector and all portions of the tooth and surrounding area other than the apex, are either elongated or foreshortened, depending upon the angle formed between either film or object and the divergent rays.

(V) Since the object and film are not parallel, there is no point in theorising on the effect of the central ray failing to strike both perpendicularly.

It will be noted that, of the four factors which the operator can vary, only the third produces the optimum results.

Briefly, the long-cone, paralleling technique calls for up to a 20-inch target-to-object distance and the maintenance of the film parallel to the tooth. The following comments relate this method to the principles previously stated.

I. As in the original technique the operator has no control over the focal spot size.

II. The distance from the radiation source to the object is increased at least twofold and if other conditions are maintained, this reduces by an equal factor (a factor of two) the amount by which the shadows overlap (Fig. 5).

To the same degree, the amount of magnification is reduced as the rays used to penetrate the object are considerably less divergent (Fig. 4). (They are also less numerous, thus making it necessary to use faster films.)

III. The distance from the object to the film is variable but under no circumstances does the film contact the crown of the tooth. In some instances the distance from the tooth apex to the film is no greater than in the short-cone technique, but usually the film is held away from the tooth in order to obtain object-film parallelism. (This also permits the shadow to fall sufficiently so that the apex may be projected into the film.) Since the distance between the long axes of the corresponding right and left maxillary molars is approximately two inches, it is obvious that the object-to-film distance may be as much as one and one-quarter inches. This is approximately twice the apex-film distance when using the short target-to-object technique (Fig. 6).

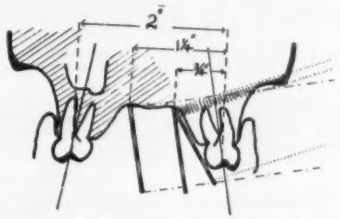

Fig. 6.—The relative position of the film to the teeth in both techniques.

IV and V. Object and film are parallel and the central ray is directed at right angles to both, midway between the apex and the occlusal surface. As a long target-to-object distance is used, the divergent rays which expose either the apex or the crown are so nearly parallel that they can be so classified for the present purposes.

Thus it will be noted that of the four factors which the operator can vary, three produce optimum results and only the third detracts from the quality of the film. Compensation for this factor is more than provided for by the increased target-to-object distance and so detail is not decreased and may be slightly improved. As magnification is controlled by the same factors as detail, it may be reduced but is not increased. Elongation and foreshortening are considerably reduced.

Having considered the two procedures theoretically, consideration should be given to a comparison of the techniques on a practical interpretive basis. Since correction of distortion (elongation and foreshortening) is the principal advantage of the paralleling technique over the shortcone procedure, comments will be restricted to that phase.

One of the principal features in the interpretation of periodontal disease is the determination of bone level. When the rays strike the tooth perpendicularly the anatomical relationship between buccal and lingual plate and the tooth are maintained. As the rays are angulated the relationships may change to such a degree that the buccal bone is often cast on to and above the cemento-enamel

junction. (Fig. 7). In this way also, bifurcation involvement is often obliterated.

Interproximal carious lesions are ordinarily located below the bulge of the contacting

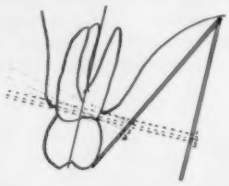

Fig. 7.—Lingual bone (1), buccal bone (2) and cemento-enamel junction (3) in correct relation using a paralleling technique and projection of buccal bone above cemento-enamel junction with lingual bone well below using a bisecting-angle technique.

area on the periphery of the crown. When the rays are other than perpendicular to the long axis of the tooth, the relationship is destroyed and the defect is cast on to the massive enamel above (Fig. 8). Likewise, occlusal caries seen at the dentino-enamel junction can, through faulty angulation be cast on to the occlusal enamel. In both instances the small carious lesion is obliterated.

Apical degenerative change as seen in films taken with the short target-to-object technique is distorted to a lesser degree than either periodontal or carious destruction. Nevertheless, increased angulation tends to superimpose the apical area on the root substance to the extent that small increases in the size of the periodontal space are easily overlooked (Fig. 9).

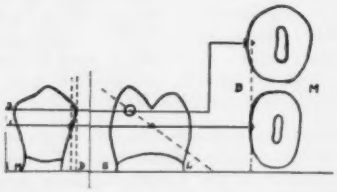

Fig. 8.—Diagram showing that an incipient carious lesion at level (1) can be projected, through incorrect vertical angulation, into the enamel at the level of the contact point (2); and hence is obscured.

A further important practical application of the paralleling technique is seen in films taken for the maxillary molar teeth[11]. Using the bisecting angle technique, the shadow of the zygoma is usually thrown across the apices of the teeth rendering the area useless for diagnosis. If the central ray is directed at right angles to the molars and film it will quite comfortably pass beneath the zygoma (Fig. 6).

CONCLUSION.

Facts of diagnostic importance may be derived from intra-oral roentgenograms regardless of which technique is used. Certain inherent shortcomings in the short-cone procedure render complete interpretation more difficult. With minor exceptions the short-cone technique has no distinct advantages while the long-cone procedure is both theoretically and practically more adaptable to intra-oral roentgenographic studies. Although not emphasised in this paper, much has recently been written about the reduction in total radiation received by the patient when the long-cone procedures are used in preference to the more generally accepted method[12, 13, 14].

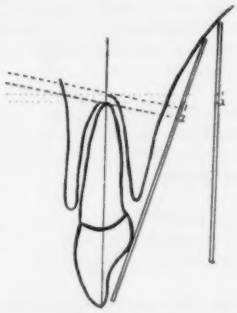

Fig. 9.—Diagram showing how a break in the lamina dura (1-2) at the apex may be projected on to the apex in the bisecting-angle technique.

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Editorial

This journal is published by the Australian Dental Association (New South Wales Branch), B.M.A. House, 135 Macquarie Street, Sydney. Communications concerning literary matter should be addressed to the Editor and all advertising and business matters directed to the Secretary.

Subscription rate is £1/5/- per annum (Aust.); £1/10/- per annum outside Australia. Single copies, 5/-

Original communications: Manuscripts should be typewritten on one side of the paper only, with double spacing and liberal margins. Carbon copies should not be sent. References should be placed at the end of the article and should include, in the order given, name of author, title, journal, volume, initial page of article, month and year; e.g., Wallace, J. S.—The newer knowledge of hygeine in diet: Dent. Items Int., 69:38 (Jan.) 1947. References to books should include the following information: name of author, title, edition, place of publication, name of publishers, year and page (if necessary).

Illustrations: These should be kept to a minimum. Suitable captions with number and author's name should be marked on the back of all illustrations. Photographic prints should be approximately 5 in. x 4 in. and printed on glossy paper. Authors unaccustomed to preparing drawings and photographic prints for reproduction are invited to seek the advice of the Editor.

All expressions of opinion and all statements of supposed fact are published on the authority of the writer over whose signature they appear and are not to be regarded as expressing the views of the Australian Dental Association.— H. R. SULLIVAN, Editor.

The Solving of a Problem

For a long time members of our profession have condemned the use of sugar and refined carbohydrates as the undoubted cause of dental caries. However, more recently, thanks to some imaginative pieces of research, it has been found possible to whittle down such extremely broad statements into more specific observations.

One outstanding piece of work, carried out in Scandinavia amongst the inmates of a mental institution, indicated that the same amount of carbohydrate eaten between meals caused more caries than when eaten at the three main meals of the day. This was in keeping with the observation at the recent World Health Organisation seminar that one of the differences between nations whose people suffered greatly from caries and those whose people were relatively free, was that the incidence of caries appeared to be related to the number of meals (in the broadest sense) consumed per day. Dentists from South East Asian countries were amazed at the institution of morning and afternoon tea in New Zealand and even the Americans were somewhat surprised at the regularity of this British habit.

Another matter upon which we are gradually becoming able to speak more authoritatively, is the use of the all-embracing term "sugars and starches." It is now becoming apparent, particularly as a result of certain "sticky food" experiments, that the caries potential of carbohydrate foodstuffs varies greatly and that it is not of necessity directly related to its "sugar or starch" content. More important is its texture and form. From these and other studies it would also appear that it is dangerous practice to assume that "natural sugars" do not have any harmful effects as far as their possessing a caries potential. Indeed the reverse may apply.

Observations of dental conditions during and after the last war have prompted another Scandinavian research worker to suggest that 60 calories of every 1,000 calories consumed can safely be eaten as sugar. This is the first time that anyone has attempted to draw a "caries threshold."

Gradually but surely research is unravelling the problems of dental caries and ultimately its prevention may not turn out to be such a trying and difficult procedure as we previously imagined.

Bureau of Dental Standards

The Bureau of Dental Standards of the Commonwealth Department of Health has published its sixth and seventh annual reports. In its preface it speaks with satisfaction, which will be echoed by the entire profession, that the Bureau has now been organised on a permanent basis. This means that the dental profession and dental manufacturers in Australia will always have the Bureau as an aid.

The Bureau's programme is a four-fold one in research, testing, preparation of standards and information relating to dental and allied materials. All of these branches have already proved their worth.

At times a piece of work is only as good as the materials available for that work and many of us will remember with horror, the poor quality materials that at times were the only ones available when the last war prevented the importation of overseas stocks. However, with the advent of the Bureau of Standards and the happy co-operation between it, the profession and the manufacturers, this state of affairs has disappeared and many Australian products could now well take their place on the world market. Australian specifications have been laid down and dentists can be quite sure that attested materials will give reproducible results of high standard.

We offer our congratulations to the Bureau upon the excellent work they are doing for dentistry and we are glad that the Commonwealth Department of Health has been able to arrange for the permanence of this fine institute.

Australian Dental Association Standards Committee

List of Certified Materials.

27th April, 1954.

The Standards Committee of the Australian Dental Association has announced its revised list of certified dental products and members of the profession are again reminded of the importance of using these lists as a guide when purchasing dental materials. By using products accredited by the Committee, not only will the dentist be assured of obtaining a product which has been proved satisfactory when used as directed, but it will also encourage the continued manufacture and distribution of high-quality materials.

The certified products are listed under each Australian Dental Standard (A.D.S.) together with the name of manufacturer or distributor. Several new products, including artificial stones, have been added, but it will be noted that, to date, no impression plasters or laboratory plasters have been accredited.

Certified Mercuries (A.D.S. No. T.1):—

Ash Chemically Pure	The Amalgamated Dental (Aust.) Pty. Ltd.
Bosch	Bosch Naylor Pty. Ltd.
Glover & Goode Dental	Glover & Goode Pty. Ltd.
May & Baker	May & Baker (Aust.) Pty. Ltd.

Certified Amalgam Alloys (A.D.S. No. T.2):—

Baker's Aristaloy	Glover & Goode Pty. Ltd.
Bosch	Bosch Naylor Pty. Ltd.
Bosch 70%	Bosch Naylor Pty. Ltd.
Capellet	Dental Fillings Limited.
Crompton	Crompton Dental Products.
Crompton 70%	Crompton Dental Products.
F. & G. 70%	Felton Grimwade Dental Co. Pty. Ltd.
G. & G. Medium Setting	Glover & Goode Pty. Ltd.
G. & G. Quick Setting (Standardised)	Glover & Goode Pty. Ltd.
G. & G. 70%	Glover & Goode Pty. Ltd.
Jendent 68%	John T. Jennings Pty. Ltd.
K. & L.	Kemp & Liddell Pty. Ltd.
Premodent	Milne Browne & Co. Ltd.
Six Eighty	Garrett, Davidson & Matthey Pty. Ltd.
Solila Quick Mixing	The Amalgamated Dental (Aust.) Pty. Ltd.
Solila Standard Formula	The Amalgamated Dental (Aust.) Pty. Ltd.
True Dentalloy	The S. S. White Co. of Australia Pty. Ltd.

Certified Zinc Phosphate Cements (A.D.S. No. T.3):—

Dalton's Zinc	The Dalton Chemical Co.
De Trey's Improved	The Amalgamated Dental (Aust.) Pty. Ltd.
S.S.W. Zinc Improved	The S. S. White Co. of Australia Pty. Ltd.

Certified Impression Plasters (A.D.S. No. T.4):—

No products yet accredited.

Certified Laboratory Plasters (A.D.S. No. T.5):—

No products yet accredited.

Certified Modelling Compounds (A.D.S. No. T.6):—

Type A—Impression Compound

Pinnacle ..... The Amalgamated Dental (Aust.) Pty. Ltd.

Type B—Tray Compound

No products yet accredited.

CERTIFIED ARTIFICIAL STONES (A.D.S. No. T.7):—

Type A—Low Expansion

*Calestone (*for purposes other than vulcanising*) ..... The Amalgamated Dental (Aust.) Pty. Ltd.
Investo Greenstone ..... Investo Manufacturing Co. Pty. Ltd.

Type B—Compensating

Investo Diestone ..... Investo Manufacturing Co. Pty. Ltd.
Investo 30-minute Yellowstone ..... Investo Manufacturing Co. Pty. Ltd.

CERTIFIED SILICATE CEMENTS (A.D.S. No. T.8):—

Astralit Improved ..... Dental Fillings Limited.
S.S.W. Filling Porcelain Improved ..... The S. S. White Co. of Australia Pty. Ltd.
Syntrex ..... The Amalgamated Dental (Aust.) Pty. Ltd.

*For the time being, accredited for 1-cwt. drums only.

Dental Materials

Current Notes No. 26*

The Dental Materials Sectional Committee of the Standards Association of Australia recently met to consider a number of materials for which Australian standards are being prepared. The position at present is that there are eight official Australian standards already published and these are being used by the Australian Dental Association for the accreditation of products certified by the manufacturers or distributors to comply with the relevant standard. These standards are:

A.S. No. T.1—Dental mercury.
A.S. No. T.2—Dental amalgam alloy.
A.S. No. T.3—Zinc phosphate cement.
A.S. No. T.4—Dental impression plaster.
A.S. No. T.5—Dental laboratory plaster.
A.S. No. T.6—Dental modelling compound.
A.S. No. T.7—Dental artificial stone.
A.S. No. T.8—Dental silicate cement.

Amendments to two of the specifications are being considered as a result of technical complications connected with the reproducibility of test results. In order to ensure that different operators and different laboratories obtain the same results when using a particular product, some alterations are necessary. The problem has been resolved with modelling compounds (A.S. No. T.6), but work is continuing on the more difficult case of amalgam alloys (A.S. No. T.2).

The preliminary work of preparation of Australian dental standards is undertaken by seven technical sub-committees appointed to consider particular groups of materials and by the New South Wales sub-committee which reviews draft specifications and makes suggestions for their improvement. The work of these sub-committees have been considerable and some of it is outlined hereunder:

Sub-Committee on Gypsum Products—The work of this Sub-Committee has resulted in the publication of three standards, namely, T.4, T.5 and T.7. Its main problem at present concerns the preparation of a standard for dental casting investments; a project has been referred back to the Commonwealth Bureau of Dental Standards with a view to preparing a performance specification instead of relying on the somewhat theoretical procedure of summing the expansions obtained in the various steps of preparing a mould into which an alloy is cast.

Sub-Committee on Impression Materials—Agreement has been reached in regard to the amendments to the standard for dental

*Contribution from the Commonwealth Bureau of Dental Standards.

modelling compounds. Standards for hydrocolloidal impression materials (agar and alginate types) are nearing completion and it is expected that a draft for public critical review will soon be available to members of the profession and others. Work is proceeding on the preparation of a draft specification for impression pastes.

Sub-Committee on Dental Golds — The specifications for inlay casting golds and denture casting golds are almost completed and it is expected that these will soon be available. The draft standard for wrought golds should also soon be available for public review. Future projects intended for this Sub-Committee include solders and orthodontic wires.

Sub-Committee on Dental Cements—Following the preparation of the two Australian Standards for cements, T.3 and T.8, this Sub-Committee has no work in hand at present.

Sub-Committee on Waxes—An Australian Standard for inlay casting wax is nearly ready for printing. A standard for sticky wax is well advanced but one for modelling wax has been deferred pending further investigations at the Bureau of Dental Standards concerning the desirability of having more than one type of wax—for example, a wax for summer and another for winter use. Bite wax was at one stage under consideration but it is now felt that the preparation of a standard for this material is not justified.

Sub-Committee on Resins — Considerable progress has been made in connection with the preparation of a standard for denture base resins. Further proposed projects include the preparation of a specification for synthetic resin teeth. It is of interest to note that in other parts of the British Commonwealth there are developments in this field — the British Standards Institution has drafted a specification for denture base resin and the South African Bureau of Standards is preparing a specification for acrylic teeth.

Sub-Committee on Biological Products—This is the most recently formed Sub-Committee and has not yet met. The Committee is awaiting the submission of a draft standard for local anaesthetic solutions which has been prepared at the Bureau of Dental Standards.

Other Sub-Committees—The formation of a Sub-Committee for amending Standard T.2 for Amalgam Alloy and others for dental photographic materials and dental burs is under consideration.

Information from the Dental Board

The following matters are reported from meetings of the Dental Board of New South Wales, held in April, May and June, 1954.

APPLICATIONS FOR REGISTRATION.

Bakewell, William John; Berkahn, Bevan Leslie Chris; Byrnes, Robert John; Claydon, Thomas Clavering; Crofts, Howard; Donald, John Gwynne Fraser; Dwyer, Neil Colin; Gifford, Allan John; Glancey, John Michael; Ingall, William Brian; McManus, John Barry; Scotton, Barry Carlton; Sheedy, John Joseph; Somers, Nihill Henry; Wall, Colin Hart.

O'Donnell, Bernard John, B.D.Sc., Univ. Q'land, 1952, and Tighe, Noel Bede, B.D.Sc., University Q'land, 1950.

ADDITIONAL QUALIFICATIONS.

Fortescue, Rex Edward, B.D.S., Univ. Syd., 1948, M.D.S., Univ. Syd., 1954.

RESTORATIONS TO REGISTER.

L. J. Cosh, R. T. Stannard and A. W. W. Peterson.

GRANT.

The Board approved payment of the sum of £400 from the Dental Board Education and Research Account as a grant to the Dental Health Education Department of the Australian Dental Association, New South Wales Branch.

ADDITIONAL DESCRIPTION.

An application for permission to use the letters "Ph.C." in connection with the practice of dentistry was refused.

REGULATION 29 — ASSISTANTS.

It was noted that Mr. R. Broughton was employing Mr. B. L. Berkahn.

Letters to the Editor

Sir,

The American Journal of Physical Anthropology of December last contains a paper* in which the author stated: "Some aspects of the face have never had their split-line patterns reported, such as the nasal surface of the maxilla and the temporal surface of the zygomatic bone." He goes on to say—"with these limitations of present knowledge in mind, further investigations using the split-line technique were undertaken."

These anatomical details were investigated in Sydney 10 years ago and were published in your Journal in 1946. They may possibly have been done somewhere else before that.

—A. C. GABRIEL

Department of Anatomy,
University of Sydney.

*Tappen, N. C.—A functional analysis of the facial skeleton with split-line technique: Am. J. of Physical Anthrop., 11:503, 1953.

News and Notes

University of Sydney Post Graduate Committee in Dental Science

The following programme is published in order that intending applicants may be cognisant of the scope of this next post-graduate course.

Course No. 45: Public Health Dentistry.

8th November, 1954, to 19th November, 1954.
Fee for course—£12/12/-.
Lecturers: Dr. H. O. Lancaster, Dr. F. W. Clements, Dr. H. R. Sullivan and Mr. R. Harris, M.D.S.

Monday, 8th November.

Introduction.
Concept of public health dentistry.
Factors responsible for moulding the young infant within the pattern of Society.
Review of public health dental services (Part 1).
Statistics.*

Tuesday, 9th November.

Salient factors necessary for physical growth, emotional and social development (Part 1).
Review of public health dental services (Part 2).
Aetiology and prevalence of dental caries and periodontal diseases.
Statistics.*

Wednesday, 10th November.

Statistics.*

Thursday, 11th November.

Salient factors for physical growth, emotional and social development (Part 2).
Bacteriology of dental caries.
Clinical survey and tabulation (Part 1).
Statistics.*

Friday, 12th November.

The services available in the community to assist parents to achieve satisfactory growth and development of their children.
Clinical demonstration at the Lady Gowrie Centre.
Statistics.*

Monday, 15th November.

Dental Health Education (Methods) (Part 1).
Planning specific dental programmes.
Pedodontics and public health.
Statistics.*

Tuesday, 16th November.

Dental Health Education (Part 2). (Nutrition and Oral Hygiene).
Clinical survey and tabulation (Part 2).
Statistics.*

Wednesday, 17th November.

Statistics.*

Thursday, 18th November.

Eruption growth and development.
Evaluation of dental programme and evaluation of clinical survey.
Statistics.*

Friday, 19th November.

Child management as a clinical problem.
Clinical problems in public health dentistry.
Recapitulation and review.

*The course in Statistics will be devoted to lectures and tutorial classes in the following:
1. Description of a survey and tabulation.
2. Description of a population.
3. Tabulation of mean and standard deviation.
4. Graphical methods and tabulation of results.
5. Analysis of variance.

Honour for Brigadier H. McD. Finnie

The name of the Director of Dental Services of the Royal Australian Army Dental Corps, Brigadier Hector McD. Finnie, appeared in the recently announced Queen's Birthday Honours List as a recipient of the Order of Commander of the British Empire. It has also been announced that he has been appointed as an Honorary Dental Surgeon to Her Majesty the Queen.

The service career of Brigadier Finnie started many years before the Second World War. At the outbreak of hostilities he turned back from a proposed study tour of U.S.A. to become a member of the 2nd/1st Australian General Hospital. He was in charge of the Dental Services in the Middle East until the arrival of Col. (later Brigadier) J. Down, and during that time he laid valuable foundations for the dental services and dental supplies in the Middle East.

A recital of Brigadier Finnie's record would be too lengthy for these pages. Sufficient to say that he saw service in practically every area where Australian troops were engaged. He was mentioned in despatches and made an Officer of the British Empire. At the conclusion of hostilities he was placed on the reserve of officers, but, on the retire-

ment of Brigadier J. Down, was appointed to the position of Director of Dental Services with the rank of Brigadier.

Brigadier Finnie also has an intense interest in the teaching of Dentistry and, for some nine years has held a part time appointment as a teaching fellow in the Department of Operative Dentistry of the University of Sydney.

The members of the dental profession are pleased to see the recognition of the work of the Dental Services and are delighted with the personal acknowledgment of the fine work of Hector McDonald Finnie.

Norman Eynon Edney Honoured

It is very gratifying to learn that Norman Eynon Edney has been elected a Fellow of the International College of Dentists. The warmest congratulations of the dental profession are extended to him as recipient of this International honour and recognition of his long distinguished service in the profession.

He held the office of president of the New South Wales Branch of the Australian Dental Association in the difficult years of 1949 to 1951 and again in 1953. Through his great sagacity, strong leadership and tireless energy as well as immeasurable sacrifice of time to the detriment of his practice and family interests he has commanded the fullest confidence and respect of all members. Conjointly he has carried out the duty of honorary secretary of the Federal Office of the Association and has maintained as honorary secretary constant care of the St. George Dental Society which he founded.

Since 1941 Mr. Edney has been a member of the Executive of the New South Wales Branch and did notable work as an officer of the XIIth Australian Dental Congress in 1950.

His splendid record of service has been inspired by a very high sense of professional responsibility only tempered by a satisfaction which Emerson describes as "the reward of a thing well done is to have done it."

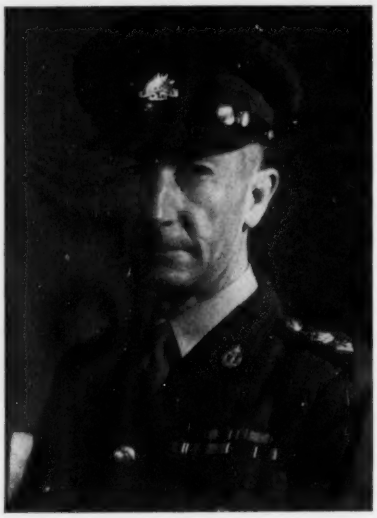
Just as some soldiers and statesmen become admired during the fullness of their life as a national institution, so might Mr. Edney be viewed as a dental institution, held in high esteem and affection by this profession. He meets the times which demand strong minds, great hearts, true faith and willing hands—men whom the pomp of office does not destroy —men who possess opinions and a will—men who have honour.

The degree conferred by the International College of Dentists is a true tribute to Mr. Edney's qualities and service.

Lt.-Col. J. W. Skinner, E.D.

The news that Lieutenant-Colonel J. W. Skinner, E.D., has been appointed Honorary Dental Surgeon to His Excellency the Governor-General will be warmly received.

After playing a prominent part in the pre-war dental services, he became one of the first dental officers to go to the Middle East.



On his return he saw service in many theatres of operation in Australia and in the Islands.

Since the end of the war he has devoted much of his time to the Army as Assistant Director of Dental Services, Eastern Command and has been responsible for a great part of the peace-time planning and training of the dental services in New South Wales.

In addition to these duties, Lt.-Col. Skinner found time to serve for some years on the Executive Council of the State branch of the Association.

Western Suburbs Sports Day

The Western Suburbs Dental Group held their annual sports day at Concord Golf Club in May. The events, contested by more than 100 competitors, resulted as follows:

Golf —

Cup winner: F. C. Weir, up 4.

Cup runner-up: J. Gillies, up 1.

4 ball winners: J. Gillies, J. Newman, up 7.

Runners-up: I. Steele, N. Locke, up 7.

A grade: P. Anderson, square.
B grade: J. Newman, up 1.
1st nine: F. Holt, up 1.
2nd nine: I. Steele, up 2.
Sealed nine: J. Butt.
Pitch and putt: J. O. Martin.
Long drive: H. Ratcliffe.

Bowls —

Winners: V. Slocombe, L. Burgess, S. Fox, R. Chapple.
Runners-up: W. Chesher, R. Hawthorne, G. Allen, H. Sengelman.

Association Activities

Australian Dental Association (New South Wales Branch)

General Meetings.

The General Meeting of the Association for the month of May was held on Tuesday, the 25th. Members were privileged to hear an interstate lecturer in the person of Mr. A. R. Docking, M.Sc., Officer-in-Charge of the Commonwealth Bureau of Dental Standards. Mr. Docking presented a most interesting and well illustrated address entitled "Making the Most of Your Materials." An account of this paper will appear in the October issue of this Journal.

Annie Praed Lecture.

The General Meeting of 22nd June was the occasion of the annual Annie Praed lecture. The lecturer, Dr. J. H. Wilson, spoke on "Some Clinical and Technical Aspects of Partial Denture Design."

At the meeting both the President and Dr. Wilson referred to the significance of the occasion and paid tribute to the memory of the late Dr. Annie Praed.

Executive Report.

Second Country Convention, Orange.

The Convention Commission has reported to the Executive that arrangements for the clinical and social programmes of the Convention are well advanced and that full facilities for all Convention functions are being arranged.

The attention of members is drawn to the information contained in the preliminary brochure forwarded to them and to further information published in this issue of the Journal.

Resignation from Executive.

The Executive at its meeting on 10th May accepted with regret the resignation of Mr. R. G. Leeder who has departed for an overseas tour.

In accordance with Article 26 of the Articles of Association, the Executive appointed Mr. G. A. Lonsdale to fill the casual vacancy caused by this resignation.

Good Teeth Competition.

This competition in which the Association has co-operated with the Youth Welfare Association has attracted a large number of entrants and judging is taking place to select the finalists. It is hoped that prizes will be presented to the finalists during Health Week in October next.

Additions to Library.

The following books have been added to the Hardwick Memorial Library:

Textbook of Exodontia, Leo Winter
Complete Dentures, Merrill G. Swenson
Periodontia, Henry M. Goldman
Oral Hygiene, Russell W. Bunting
Internal Medicine in Dental Practice, Comroe, Collins and Crane
Surgery for Dental Students, Michael F. Woodruff.

Dental Board Grant.

The Dental Health Education Department of the Association has again received a grant of £400 from the Dental Board of New South Wales for Dental Health Education.

The Association appreciates the continued interest and support of its Dental Health Education Department by the Dental Board.

Fact Finding Committee—Dental Technicians.

The report of the Chairman of this Committee has been presented to the Minister for Health and copies have been forwarded to the various bodies represented on the Committee for their confidential perusal.

The Executive of the Association has closely examined this report which is not yet available for general distribution. Members are assured of the Executive's constant attention to this matter.

Membership.

New Members.

Atkinson, James Arnell, B.D.S.; Davis, Norman Brian, B.D.S.; Donald, John Gwynne Fraser, B.D.S.; Goodman, John Maurice, B.D.S.; Howell-Price, John Frederick, B.D.S.; Leaver, Richard Fielding, B.D.S.; Yates, Noel Thomas, B.D.S.

Student Associates.

Britt, Graham Charles; Burke, Ronald J.; Hutchison, Ian N.; Mison, John Alfred; Patterson, Gerald Aubrey; Southwick, John Havelock.

Second Country Convention September 20-24th, 1954

Orange,

N.S.W.

Golf Course and Club House, Duntryleague, Orange.

The City of Orange, situated 200 miles from Sydney in some of the most beautiful and productive country of New South Wales, has been selected as the location of the second Country Convention of the Australian Dental Association, New South Wales Branch.

The Convention Commission appointed from the personnel of the Western Division of the State Branch is using the many facilities existing in Orange to full advantage in arranging an outstanding clinical, sporting and social programme.

Already a firm foundation has been laid for a series of selected practical lectures, supported by table and silent clinics and a film programme.

Through its various committees the Commission is arranging for every comfort of members of the Convention and accommodation bookings are being made for those members who make early application.

Orange presents many advantages for the enjoyment of sport. Duntryleague golf course is famous throughout the State and first-class bowling greens and tennis courts will be available for members. Tours of the scenic countryside will be arranged.

Ladies accompanying members will be made most welcome and plans are well advanced for their entertainment.

A comprehensive trade display will be set up in conjunction with the various dental supply houses who have shown much interest and enthusiasm.

Dr. E. Johnson.

Mr. L. Beckett.

CLINICAL PROGRAMME.

The clinical programme will be led by Dr. Edwin Johnson of Melbourne and Mr. L. S. Beckett of Sydney.

Dr. Johnson is a lecturer of repute on full denture prosthesis and Mr. Beckett an authority on partial dentures.

They will be supported by Dr. E. H. Bastian (crown and bridge work), Mr. W. A. Grainger (operative dentistry), Mr. R. Harris (preventive dentistry and pedodontia), Mr. R. Y. Norton (orthodontia for the general practitioner), Mr. S. Levine (periodontia) and Mr. B. G. Broadbent (local anaesthetics).

Table clinics to be given by members of the Association cover a wide range of practical subjects, and include orthodontia, operative dentistry, children's dentistry, crown and bridge work, radiography, cleft palate prosthesis, periodontia and dental materials.

A number of silent clinics will be shown in addition to an extensive film programme.

Abstracts of Current Literature

A short note on certain selected articles appearing in current overseas journals.

The Journal of the American Dental Association, Vol. 48, No. 5, May, 1954.

Contribution of the Dentist in private practice to practice management courses for undergraduates: DeRevere, R. E., and Burket, L. W.

The teaching programme conducted at the University of Pennsylvania in which students, interested practising dentists and faculty members participated proved to be of mutual benefit to all taking part. Through conversation with the student assigned to him, the practising dentist became more aware of new developments in education. He found it intellectually stimulating to learn of the improvements in methods and subjects taught at the School of Dentistry. The programme gave the dentist an occasion to demonstrate the accomplishments required for a successful practice. The dentist welcomed the opportunity to pass his experience on to those who could best profit by it. Above all, the participating dentist felt gratified that he had contributed something toward the solution of one of the major problems of dental education, that of teaching the student how to get a successful practice started.

Ethyl Chloride treatment of limited, painful mandibular movement: Schwartz, L. L.

Ethyl chloride spray has been found useful in coaxing spastic muscles to relax. In a group of 10 patients (8 female, 2 male, average age 31.7) suffering from limited, painful mandibular movement, treatment with ethyl chloride spray resulted in recovery in seven, temporary improvement in two, and no change in one. In a similar group of ten untreated patients (9 female, 1 male, average age 33.0) there was no change in eight, temporary improvement in one, and spontaneous recovery in another.

Muscle spasm was held responsible for the limitation of movement found in both groups. Palpation often revealed the presence of spasm, which was most easily identified in the internal ptergoid muscles. Spasticity was found to be predominantly unilateral. In some patients only a single muscle of the masticatory group was involved, in others spasm also included the antigravity muscles of the neck and shoulder. Bruxism and mandibular overextension seem to be the factors most closely related to the initiation of this disorder.

The effect of penicillin G potassium plus calcium carbonate on surgically exposed dental pulps of the rhesus monkey: Seelig, A.; Fowler, R. C.; Tanchester, D.

In this experiment a paste of penicillin G potassium and calcium carbonate was placed in direct contact with the pulps of 11 teeth of a rhesus monkey. The enamel and dentin of all the teeth were sound, and the usual precautions observed in cavity preparation were taken. Neither aseptic nor antiseptic technics were followed. The paste, prepared by mixing penicillin G potassium and calcium carbonate with tap water, was forced into the preparations. In each case part of the coronal portion of the pulp was macerated by the bur.

Zinc oxide and eugenol paste and oxyphosphate of zinc cement were used as controls. When zinc oxide and eugenol paste was placed in contact with monkey's pulps, an inflammatory response occurred with abscess formation. The placing of oxyphosphate of zinc cement may have resulted in the death of the pulp because of the production of an acid medium.

In all cases in which the paste of penicillin G potassium and calcium carbonate was placed under oxyphosphate of zinc cement, a normal pulp was observed. In each case a bridge of dentin was formed. In rare instances the pulp, although within the range of normal, showed slight edema and a few polymorphonuclear leukocytes in the tissue.

New Books and Publications

COMPLETE DENTURES, by Merrill G. Swenson, St. Louis, 1953, C. V. Mosby Company. (735 pp., 882 illus.). *Our copy by courtesy of W. Ramsay (Surgical) Limited.*

This edition is divided into five parts, namely: related factors of complete denture construction, construction of complete dentures, immediate denture construction, supplemental procedures and materials, and single maxillary dentures and rebasing. The contents of the book have therefore been re-arranged in a more logical sequence than in previous editions.

The re-written portion—instructions and information for denture patients—is excellent and the chapter on anatomy and physiology in denture construction has been modernised to good effect.

The appendix (notes on the evolution of full and partial dentures) could well have been enlarged by the transfer of certain data from the main text to this "historical" section of the book. The Hickok bite strap, the Willis device for facial measurement (if used according to instructions) the Gysi face-bow (now obsolescent and replaced by less massive and lighter counterparts) are some examples of items which are honoured more for their historical significance rather than their present-day practical value.

Presumably there is an irresistible urge to illustrate the text with certain over-worked blocks, apparently supplied by various dental supply companies, which results in the retention of descriptions of obsolete equipment in edition after edition even though the use of techniques and equipment which they illustrate may be contrary to the modern physiological concept of prosthetic dentistry.

Complete absence of any reference to "gum tinting" in acrylic complete dentures detracts from the up-to-date nature of the edition.

Although considerable prominence has been given to surgical procedures associated with complete denture service it is regretted that only one surgical technique is described. As a surgical method *has* been described in so much detail, it would have been better to have at least mentioned more conservative methods of treatment such as "socketting" and "interseptal alveolotomy."

However, the new edition is perhaps the most profusely and clearly illustrated textbook on the subject of complete denture prosthesis and is well recommended to both student and practitioner alike.—*A.G.R.*

PREVENTIVE DENTISTRY, by Joseph C. Muhler, Maynard K. Hine and Harry J. Day, St. Louis, 1954, The C. V. Mosby Co. (336 pp., 42 illus.) Price 89/3. *Our copy by courtesy of W. Ramsay (Surgical) Pty. Ltd.*

Although a text in the subject of preventive dentistry is greatly needed, a clear concept of the field to be covered is even more essential. If a distinction is to be made between control techniques and prevention per se, then preventive dentistry is a very restricted subject. This book considers control measures as well as preventive measures particularly in relation to caries, 10 chapters being devoted to it. Two chapters at the conclusion of the book deal with the prevention of periodontal disease and to oral carcinoma.

After the introduction there is a rather brief chapter on the histology and pathology of the teeth, inadequately treated and insufficiently illustrated by photomicrographs. The most important aspects of the structure of the enamel surface and the changes that take place there are virtually overlooked.

Chapter III on the dynamics of the enamel and dentine gives a good account of the penetration of the enamel by dyes and radio-active isotopes. Chapter IV discusses the diagnosis and evaluation of caries and points out the need for bitewing x-rays to determine the presence of interproximal caries.

A comprehensive coverage of the factors in the natural resistance to caries is given in Chapter V. In Chapter VI the usual tests for caries susceptibility are described, and mention is made of the possible rate of saliva secretion and its relation to caries. The reader, for some inexplicable reason, is referred here to an illustration of an Ostwald viscosimeter.

The chapters dealing with the bacteriostatic agents, penicillin, ammonia and chlorophyll (VII) and the quinones and nitro-furans (VIII) are very comprehensive.

The role of refined carbohydrates in caries and the production of experimental caries (Chapter IX) is well presented and summarises a great deal of controversial research.

Chapter X on fluorine and dental caries covers all aspects of the subject. More emphasis could be given the systemic effects of fluoride and its metabolism. The mechanism of the effect of fluorine in preventing caries is only briefly mentioned.

No mention is made of specific dietary programmes for the control of caries which could have been well included in this text. Also, the prevention of malocclusion is not mentioned, and it is felt that such a subject is as equally worthy of inclusion as the other branches of preventive dentistry.

This book is a valuable one insofar as it covers the field of dental caries control and prevention very thoroughly and for this reason is a useful text for student use and also for the practitioner interested in the basic approach to the problem of dental caries control.—N.D.M.

MAXILLO-FACIAL LABORATORY TECHNIQUE AND FACIAL PROSTHESIS, by Stanley Brasier, London, 1954, Henry Kimpton (232 pp., 292 illus.). *Our copy by courtesy of the publishers.*

This well-produced book deals with the fabrication of the appliances used by the surgical teams in Maxillo-Facial Units. It is important to realise that the book is written by a technician and accordingly deals effectively only with technical aspects. However it treats these in a comprehensive manner, describing the construction of the many varied appliances in considerable detail. The book is also valuable as a convenient source of the diverse details that are so perplexing when work of this type differs from normal laboratory practice.

The main criticism of the book is that the author is too dogmatic about techniques preferring those with which he is familiar rather than some well known methods that have been proven superior in other hands. This does not detract unduly from the value of the book which is a worthwhile contribution helping to fill a gap in dental literature.—*K.P.M.*

THE FABER MEDICAL DICTIONARY, edited by Sir Cecil Wakeley, Bt., London, 1953, Faber and Faber Limited. (471 pp.) Price 45s. (sterling). *Our copy by courtesy of the publishers.*

Depending upon one's taste, a dictionary can either be a most absorbing or a most boring work. However there is no doubt that its compilation calls for meticulous care and thoroughness. It would appear that this dictionary has been edited by one fully seized with the importance of such basic requirements.

For many years there has not been an adequate British medical dictionary. As a result many American words and methods of spelling have appeared in our literature. More particularly does this apply to dental literature in relation to its more technical aspects. The status of this dictionary is sufficiently high to warrant its acceptance as a standard work and so, perhaps, British influence may become sufficiently great again to cause the replacement of such words as "etiology" by its British counterpart "aetiology."

Whilst the majority of dental words are adequately explained there are certain omissions. For example, neither the word "approximal" nor "proximal" bears any dental description. However, on the whole there is a good coverage of special dental meanings.

One also finds some words which are rarely used today, yet whose disappearance would rob our professional speech of many a colourful phrase: "odontogen," a substance producing dentine; or "odontobothritis," inflammation of the tooth socket.

The set-up of this dictionary is not elaborate and indeed it looks what I believe it to be—a very solid, reliable British production.

—H.R.S.

SURGERY FOR DENTAL STUDENTS, by Michael F. A. Woodruff, Oxford, 1954, Blackwell Scientific Publications (326 pp., 108 illus.). *Our copy by courtesy of the publishers.*

Professor Woodruff who occupies the Chair of Surgery in the University of Otago has written this book to help dental students satisfy the examiners in general surgery for

the degree of L.D.S.R.C.S. It is based on his experience as lecturer to dental students at the University of Sheffield. The author's wide experience as a teacher and examiner has given the profession a book that is packed with information, yet is presented in a clear and always interesting manner.

Clinical photographs and radiographs are of a high standard and the use of clear, simple diagrams, reminds us that often they have a greater teaching value than a collection of photographs. Students will also appreciate tables such as those summarising information on labial and lingual ulcerations. Very recent studies are covered in the chapter dealing with sulphonamides and the antibiotics penicillin, streptomycin, chloromycetin, aureomycin and terramycin. A concise and informative outline is given on the scope of radio- and x-ray therapy.

There are several statements in the field of oral surgery which could be debated but the author makes no claims to cover dental or oral surgery in this book. The book eminently achieves its purpose to cover the basic principles of surgery and regional diagnosis needed by dental students for examination requirements and subsequent practice.—*L.P.O.*

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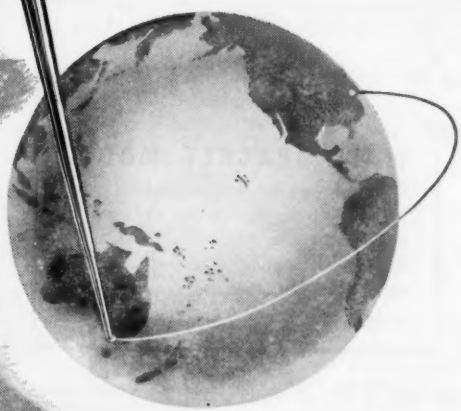

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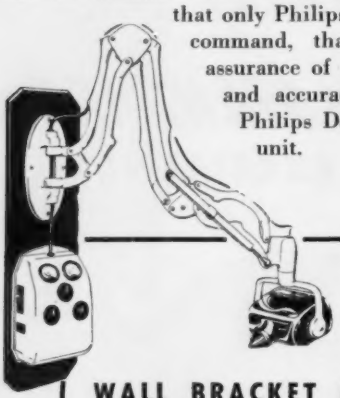

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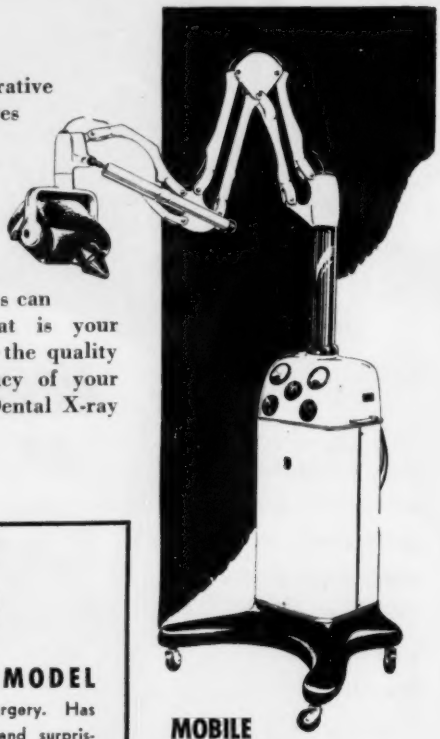

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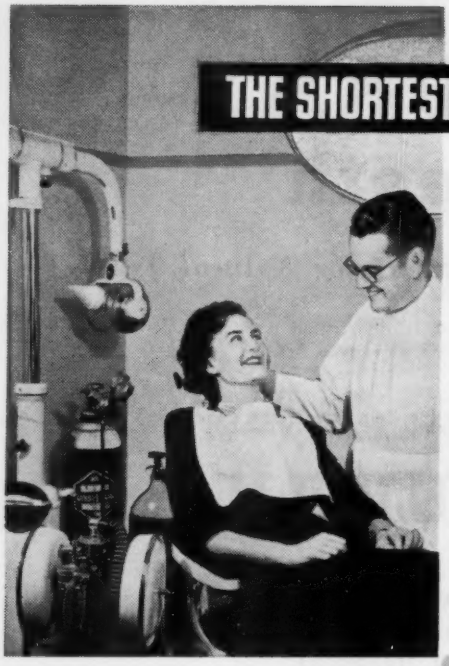

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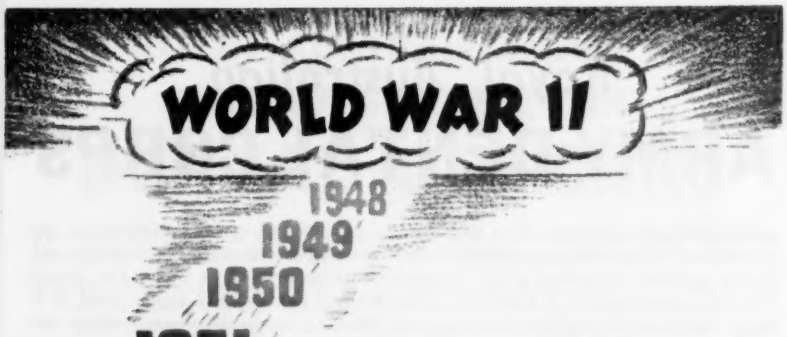

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ARMY DENTAL CORPS

Applications for appointment to short service commissions as Dental Officers in the Australian Regular Army are invited from British subjects resident in Australia and legally qualified in a State of the Commonwealth to practise as dentists or dental surgeons. Appointment is normally in the rank of Captain, but appointment in a higher rank may be made in special cases in which higher specialist qualifications are required of and held by the applicant.

Appointment is for four years with the right to terminate after two years. Dental Officers in the Regular Army will be required to serve in Australia or overseas.

PAY AND ALLOWANCES

RANK	Single Living in Camp	Single Living out of Camp	Married Living in or out of Camp
CAPTAIN	1202	1371	1417
after 2 years	1257	1426	1472
MAJOR	1394	1563	1609
after 2 years	1430	1599	1645

RETIREMENT BENEFITS AND GRATUITY

Conditions as under relative to Retirement Benefits and Gratuity are applicable to Dental Officers serving in the Australian Regular Army only.

Retirement Benefits. Officers are required to contribute to the Defence Forces Retirement Benefits Fund, from which benefits are provided in the event of death or retirement through invalidity during service. An officer who completes his engagement or resigns is entitled to a refund of his contributions to the Fund.

Gratuity. An officer who completes at least two years of his period of engagement and receives no benefit except a refund of contributions to the Fund is entitled to a gratuity of £125 for each completed year of service with a pro rata payment for each additional month of service.

LEAVE, PRIVILEGES

Leave is granted on a basis of a minimum of 18 and a maximum of 30 days per year, exclusive of Sundays and public holidays, according to the officer's area of service. Initial issue of uniform and necessaries is free. Medical and dental treatment, including hospitalization, is free.

Applications should be addressed in the respective States to :—

QLD.	HQ Nth. Command, Victoria Barracks, Brisbane.
N.S.W.	HQ Eastern Command, Victoria Barracks, Paddington, Sydney.
VIC.	HQ Sth. Command, Albert Park Barracks, Melbourne.
S. AUST.	HQ Cent. Command, Keswick Barracks, Adelaide.
W. AUST.	HQ West. Command, Swan Barracks, Perth.
TAS.	HQ Tas. Command, Anglesea Barracks, Hobart.

Further particulars may be obtained from the Assistant or Deputy Assistant Director of Dental Services at any of the above addresses.

THE ROYAL AUSTRALIAN AIR FORCE
HAS VACANCIES FOR
DENTAL OFFICERS

The Royal Australian Air Force is offering short term commissions with good conditions and pay, to suitably qualified male dentists to serve as Dental Officers.

DUTIES—Successful applicants will be appointed in the Medical Branch. Their duties will include the dental treatment of personnel at R.A.A.F. establishments within Australia and/or overseas and the examination and treatment of recruits on entry. Dental machanics and trained orderlies are employed in the dental sections which are well equipped with instruments and materials for all types of dental treatment.

QUALIFICATIONS—Applicants must be British subjects of substantially European descent. They must be registered by the Dental Board of any State in the Commonwealth of Australia and be medically fit in accordance with R.A.A.F. standards.

RANK ON APPOINTMENT—A candidate with former commissioned service in any of Her Majesty's Forces will be considered for appointment in either of his former rank or such other rank as may be commensurate with his qualifications, experience and other attributes. For candidates without former commissioned service the minimum rank on appointment will be Flight Lieutenant. Higher rank however, may be determined depending on applicant's qualifications, experience and age.

DURATION OF APPOINTMENT—Duration of a short service commission is four years. However an extension of three years may be granted.

MEDICAL AND DENTAL TREATMENT—Free medical and dental treatment, together with hospitalization is available to all members.

GRATUITY—A gratuity at the rate of £125 per annum will be paid to Dental Officers on completion of four years' satisfactory service. An Officer who resigns prior to the expiration of his commission may be paid a gratuity for time actually served at the rate of £125 per annum, provided that he has completed at least two years' satisfactory service.

PENSION SCHEME—Officers are required to contribute to a pension scheme which provides a retiring allowance and also covers invalidity or death during service. Officers who reach retiring age for rank held will receive benefits as follows :—

20 years service completed—Full pension.
15 years service completed—Pro rata pension according to years completed.
10 years service completed—Return of contributions plus gratuity of 150%.

RATES OF PAY (as at MAY, 1954)

	Single	Married
Flight Lieutenant	65/11—71/11 per diem.	77/8—83/8 per diem.
Squadron Leader	76/5—86/5 per diem.	88/2—98/2 per diem.
Wing Commander	87/11—97/11 per diem.	99/8—109/8 per diem.
Group Captain	103/5—113/5 per diem.	115/2—125/2 per diem.

Further particulars may be obtained from the R.A.A.F. Recruiting Officer, DEFENCE FORCES INFORMATION BUREAU, 77 York Street, Sydney, BX6077, or Combined Services Recruiting Centre, Beach Road, Rushcutters Bay, FB1261. Hours: Monday to Friday, 9 a.m. to 5.30 p.m. Saturday, 9 a.m. to 12.30 p.m.

If unable to call, write to Box XYZ, G.P.O., Sydney.

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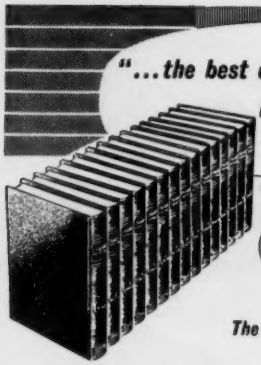

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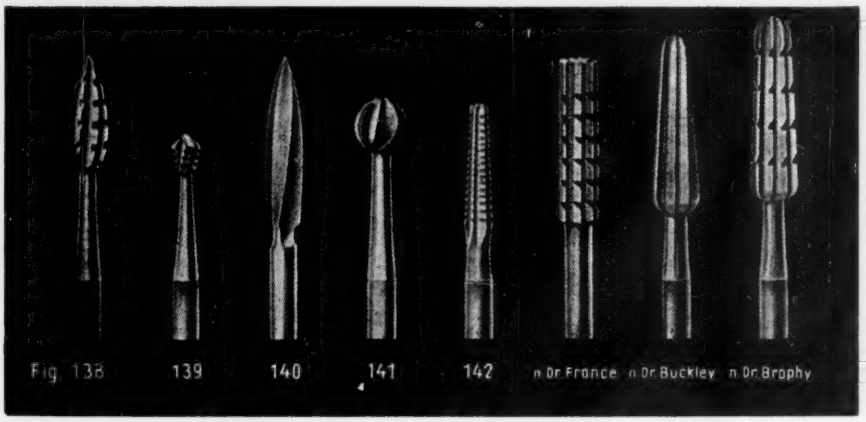

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